

CHAPTER 8

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8.00 Introduction

It is Caltrans policy to conduct its business in the safest possible manner consistent with applicable law, policy, or rule.

This chapter of the Caltrans Maintenance Manual is a part of the Caltrans written Injury and Illness Prevention Program (IIPP). It provides detailed instructions for managers, supervisors, and employees. It is designed to help employees in their efforts to work safely. All employees are expected to follow these minimum guidelines.

Other employee safety subjects are covered in other chapters of this manual, the Maintenance Code of Safe Operating Practices, and in the Caltrans Safety Manual.

The most important part of our job is to protect ourselves from traffic, while getting our work done. We do this by:

- (A) Letting the motorist know what's going on and where to drive.

For this we use signs, flags, barricades, cones, flashing amber lights, portable changeable message signs (PCMS) and flashing arrow signs (FAS).

- (B) Avoiding the errant driver.

Face traffic, stay aware through your own eyes and ears or those of a lookout who will warn you. Plan your escape route.

- (C) Using protective equipment.

Protective vehicles, headrests, seat belts/shoulder harnesses, and personal protective equipment as described in the Caltrans Safety Manual, Chapter 12.

- (D) Planning the work to reduce employee exposure to traffic.

8.01 Managers and Supervisors Responsibilities

The following paragraphs summarize the basic elements of the Caltrans Injury and Illness Prevention Program and define who is responsible for enforcing the safety and health policies and practices. For further information, consult Chapter 1, of the Caltrans Injury and Illness Prevention Program, in the Caltrans Safety Manual.

- (A) Supervisors and managers are the responsible persons to implement, maintain, and enforce Caltrans safety rules and policies.
- (B) Supervisors, in cooperation with training personnel, shall ensure that all employees receive safety related training to include:
 - (1) General training to cover hazards basic to all places of employment.
 - (2) Specific training to cover hazards that are unique to each employee's job assignment.
- (C) Supervisors shall ensure that each employee is able to understand how to complete each assigned task safely.
- (D) Supervisors shall ensure that each employee follows safe and healthy work practices and procedures, and shall initiate corrective action for non-compliance.
- (E) Supervisors shall keep abreast of safety and health regulations affecting the operations they supervise.
- (F) Supervisors shall ensure that each employee is provided with the equipment necessary to complete assigned tasks safely.

Supervisors or managers who observe an employee that appears to be unable to perform his/her assigned duties and have a concern about the safety of the employee or others, are responsible to prohibit that employee from continuing to work. The employee should be prohibited from working until a determination of the reason for the employee's behavior is made, or until a medical evaluation of the employee's fitness can be completed.

Any supervisor or manager who fails to enforce safety and health policies, procedures, regulations, laws, or rules shall be disciplined in accordance with the provisions described in the Guide to Employee Conduct and Discipline (Department of Personnel Administration).

Supervisors and managers shall ensure that employee safety and health issues are discussed and assessed with employees at least annually at the time of issuing an Individual Development Plan/Performance and Appraisal Summary, and/or at the time supervisors discuss employee probationary reports.

Supervisors in office work settings should include discussions about health and safety matters at routinely scheduled staff meetings, but at a minimum, shall have meetings with their employees at least quarterly to discuss safety and health issues.

Supervisors in field locations shall have tailgate safety meetings at least every ten (10) working days to be in compliance with the requirements of the Construction Safety Orders, CCR1509 (e), or when starting new work activity to comply with Code of Safe Operating Practices.

Supervisors shall also conduct pre-job/post-job meetings with employees whenever a new process, chemical, or procedure is introduced that contains a new or previously unrecognized hazard, or when a new or previously unrecognized hazard is identified.

Supervisors shall provide initial safety orientation to new employees including, but not limited to, the specific hazards of the job, required personal protective equipment, Chapter 8, and the Code of Safety Operating Practices.

8.02 Individual Responsibilities

Employees shall do everything reasonably necessary to protect their own safety and health and that of others by complying with all safety and health policies, procedures, laws, rules, or regulations. Employees shall report all injuries, illnesses, or unsafe conditions to their supervisor immediately or at least by the end of the work shift.

Employees are expected to report to work mentally and physically capable of performing all of their assigned duties without jeopardizing the safety and health of themselves, other employees, or the public. Employees shall be free from the effects of medication, controlled substances, alcohol, or the complications arising from illness or injury, which might impair their judgment and/or ability to perform their work.

Employees are responsible to notify their supervisor of any personal medical condition or prescribed medication use that might impair their ability to perform their assigned duties. Employees should also report to their supervisor any behavior by another employee that reasonably indicates that they are not fit for duty.

Any employee who violates any safety and health policy, procedure, regulation, law, or rule will be disciplined in accordance with the provisions described in the Guide to Employee Conduct and Discipline (Department of Personnel Administration).

8.03 Responsible Person In Charge

It is practice and policy that whenever two (2) or more employees are assigned to work together, one of the employees shall be placed in charge.

This responsibility is usually assigned to the designated supervisor or leadworker based upon his/her civil service classification. However, there may be occasions when these individuals are unavailable to direct the work for given periods of time, or where emergencies arise that require non-supervisory employees to direct the work of others.

Supervisors must always designate an individual to be in charge during any work assignment or absence, and identify the steps to be taken in the event of an emergency.

8.04 Work Site Safety

Managers and supervisors are responsible to:

- (A) Routinely inspect all field and facility work areas under their jurisdiction to identify, document, and eliminate hazards that may contribute to injuries or illnesses. In order to accomplish this, Region Managers should do three (3) or more safety reviews per month, and Area Superintendents should do three (3) or more field or facility safety reviews per week. Supervisors should be routinely inspecting work sites and work areas and documenting/correcting any deficiencies.
- (B) Ensure that employees are properly trained and equipped to do the job, and that they understand how to do it properly.
- (C) Investigate every injury or illness and vehicle accident to: (For further information, refer to the Caltrans Safety Manual, Chapter 4).
 - (1) Determine contributing circumstances, and
 - (2) Develop information that leads to correcting unsafe conditions and unsafe acts.
- (D) Establish and maintain codes of safe operating practices, or equivalent, which identify hazards specific to job assignments.
- (E) Enforce all rules, laws, and policies that will promote, protect, and preserve employee safety and health.

8.05 Changing Chapter Standards

Chapter 8 requirements are intended for the usual situations. Unusual circumstances may call for greater or lesser protective measures than are described here as standard. It is not possible, or even desirable, that a manual such as this contain detailed rules for every possible situation. It is up to the supervisor to exercise judgment in applying these measures. Supervisors should not, through the use of protective devices, create greater hazard to their crews by increasing the severity and/or duration of exposure. They should consider all factors, particularly the safety of their employees, when applying the requirements of this chapter.

Deviations from standard measures may be judged desirable by the supervisor for a variety of reasons such as sight distance, proximity of ramps or street intersection, restrictive width, short duration of job at one location, or minimal exposure because of volume, speed, and proximity of traffic. **Decisions to reduce standard measures must have the written approval of someone responsible for the work at the Area Superintendent level or higher.** This written approval shall describe the deviation and list the reason(s) it is needed. It shall be kept on file in the region office for three (3) years. This written approval is not needed in situations which develop suddenly and unexpectedly and demand immediate action to prevent injury or harm to workers or the traveling public. Operations should be brought up to standard as soon as resources become available. The supervisor may increase worker protection using standard devices without approval.

The standard lane closure plans, Standard Plan T10 through T17, are for normal work zones and conditions. In unusual situations, the Maintenance Engineer may request District Traffic Operations to authorize a deviation at a specific location, providing:

- (A) The specific location is identified by county, route, and postmile.
- (B) The deviation does not compromise the safety of workers.
- (C) The deviation is not for general use throughout the district.
- (D) The deviation and rationale are documented in district files.

The intent is to allow deviation at specific locations without creating individual district wide standard plans. A deviation could be allowed for an indefinite time at a specific location, if the special conditions remain unchanged.

8.06 Relation of Chapter 8 to Manual of Uniform Traffic Control Devices (MUTCD) and California Supplement (Part 6)

In 2004, Caltrans adopted the Manual of Uniform Traffic Control Devices (MUTCD) as amended by the MUTCD California Supplement (CA Supplement). Part 6 of each manual establishes standards for traffic controls in highway construction and maintenance work zones. The MUTCD is published by the Federal Highway Administration (FHWA), while the CA Supplement is published by the Division of Traffic Operations. In case of any inconsistency between the MUTCD and Chapter 8 of Maintenance Manual, Volume One, Maintenance forces are to follow Chapter 8 since, in certain instances, Chapter 8 requires more stringent measures. Signs referenced with (CA) in this chapter indicate a California sign code. Otherwise, the sign code referenced is a Federal sign code.

8.07 Personal Protective Equipment

Caltrans provides the personal protective equipment (PPE) employees will need to work safely. This equipment is for worker protection and they shall use it properly to prevent injuries/illnesses.

Personal protective equipment consists of many items. Hard hats, ANSI Class II or III warning garments, safety glasses, earplugs or muffs, gloves, goggles, respirators, raingear, and foot protectors are some examples.

The supervisor should select and provide the proper equipment and ensure workers wear it.

Refer to Appendix C of the Code of Safe Operating Practices and Chapter 12 of the Caltrans Safety Manual for more information about personal protective equipment. Refer to Chapter 15 of the Caltrans Safety Manual for the requirements when using respiratory protection.

8.08 Emergency First Aid

All Maintenance employees should be trained in Standard First Aid during the first three (3) months of their assignment, and at least once every three (3) years thereafter. All Tree Maintenance Workers and related classifications, and all designated Electrical personnel shall be trained in Cardio Pulmonary Resuscitation (CPR) during the first month of their assignment, and then at least once a year thereafter. The training must be certified by the American Red Cross or other accredited organization.

An approved first aid kit shall be available at each work site. First aid kits and supplies shall be kept in sanitary and usable condition and inspected at least monthly. The Caltrans Safety Manual, Section 9.09 and 9.10, specifies size, location, and quantity of supplies for various categories of first aid kits.

For more information on first aid and emergency medical care see Chapter 9 of the Caltrans Safety Manual.

8.09 Medical Treatment

Supervisors are responsible to ensure that if an injured or ill employee needs medical attention he/she will be taken to the nearest approved medical clinic or hospital emergency room for treatment. Supervisors shall post the name and location of each approved medical service provider in a conspicuous place at each Caltrans work site. At a minimum, they shall be posted on designated bulletin boards in hallways or individual offices, and other appropriate locations, such as motor vehicles, to ensure every employee is aware of the locations. A list of approved medical service providers is also available at the Caltrans Intranet, Administration, Health and Safety Information web site.

If the injury is serious, an ambulance should be called.

A supervisor or designee shall always accompany the injured or ill employee to the medical facility.

As conditions warrant, the supervisor should talk with the attending physician to determine the extent of the injuries, the affected employee's recovery period, ability to return to work, and the employee's ability to perform the full range of duties upon release.

The supervisor must describe to the doctor what modified duty is available so that the employee can return to work as soon as possible.

Employees shall report any work-related injury to their supervisor immediately, or at least before the end of the work shift. They shall also report the injury to the supervisor before going to a doctor.

For more information on reporting personal injury accidents and illnesses see Chapter 10 of the Caltrans Safety Manual.

8.10 Definitions

Moving Operations	A moving operation is any work activity that moves along the traveled way or shoulder slower than the prevailing speed of traffic. Moving operations may also involve short and/or periodic stops. On-foot exposure (for example, to remove a large piece of debris in front of a sweeper) must be held to a minimum and physical protection from traffic is required. Some examples are striping, sweeping, spraying, raised pavement marker replacement, etc.
Short Duration Operation	In general it can be defined as any activity that can be performed in 20 minutes or less during light traffic volumes, without interfering with traffic or placing the employee in jeopardy. Short duration activities are those in which it takes longer to set up and remove the traffic control zone than to perform the work. Some examples are pothole patching, removing a large piece of debris, etc. A protective vehicle or lookout must be used.
Stationary Operation	A stationary operation is any work activity that includes workers on foot or equipment occupying any part of a paved shoulder or the traveled way at one location for more than 20 minutes.

8.11 Protective Vehicles

There are three (3) classes of protective vehicles: Shadow, Barrier, and Advance Warning.

(A) Shadow Vehicle

A shadow vehicle is used to protect the work vehicle in a moving operation. A shadow vehicle shall:

- (1) Have a truck mounted attenuator (TMA) which softens the blow to our driver, and usually reduces the impact to the motorist. It does not reduce the distance a vehicle will roll ahead when hit.
- (2) Must be equipped with Type II FAS.
- (3) Be equipped with headrests or high back seats.

- (4) Be equipped with seat belts and shoulder harnesses.
- (5) Be equipped with a two-way radio.

The shadow vehicle's headrest/high back seat protects the driver's head and neck. The seat belt and shoulder harness prevent the driver from being thrown forward. Normally, the shadow vehicle shall be occupied by the driver only. However, if a passenger must occupy the vehicle while it is shadowing, the passenger seat shall also be equipped with headrests or high back seats and a seat belt and shoulder harness.

The purpose of a shadow vehicle is to provide physical protection for crews and their vehicles. The mass of the shadow vehicle is the most important factor in providing protection. The heavier the shadow vehicle, the better the protection that is provided.

The shadow vehicle shall be positioned upstream from the work vehicle between approaching traffic and the vehicle it is protecting. It should be positioned where it will provide the best protection; not too close, or not too far back. It must be positioned a sufficient distance in front (upstream) of the workers or equipment being protected to allow for appropriate vehicle roll-ahead, but not so far that errant vehicles will travel around the vehicle and strike the workers/equipment.

When making the decision as to how to position the shadow vehicle, you must use your best judgement. Because every situation will be different, you should take into consideration the following factors:

- Volume and speed of traffic—
 - With higher speeds comes the potential for increased roll ahead if struck
 - Will traffic volume affect the level of protection needed?
- Physical configuration of the roadway itself—
 - Curves vs. straight sections
 - Hills or dips that impair forward vision
 - Super elevation of curves
 - Width of improved/unimproved shoulders
- Sight distance—
 - How much sight distance is available?
- Weather and pavement conditions—
 - Dry, wet, icy
 - Rough pavement

Discuss the above factors with your work crew prior to going out on the road. Maintain two-way radio contact with the work vehicle so that movements are coordinated.

(B) Barrier Vehicle:

A barrier vehicle is an unoccupied vehicle or piece of equipment used to protect workers from errant motorists. Any vehicle at a work site can be used as a barrier. However, workers shall use the heaviest vehicle reasonably available. In certain instances, more than one (1) barrier vehicle may be needed. A barrier vehicle does not require a TMA. However, if a TMA is available, it should be used.

Any vehicle that is used should be parked upstream from the work site between approaching traffic and the workers. It should be parked where it will provide the best protection; not too close to the workers, not too far back. It shall be carefully positioned so that it will intercept errant vehicles, but will not roll ahead into the work area. Always park the barrier vehicle with the emergency brake set and lower any attachments to the ground.

A barrier vehicle without a TMA can be parked a number of ways. It can be parked at an angle or even straight across the lane. If it is parked at an angle, the front of the vehicle should be pointed away from traffic. The wheels shall be turned away from the work zone and away from traffic, if possible. This will avoid motorist panic and prevent secondary collisions if the barrier vehicle is hit and pushed ahead. A barrier vehicle with a TMA should normally be parked parallel with the direction of traffic.

(C) Advance Warning Vehicle:

An advance warning vehicle is driven or placed upstream from a work zone (refer to the Moving Lane Closure Plans T15, T16 or T17). It alerts the approaching motorists of work being performed on or near the travel way.

On the shoulder of a two-lane highway, it shall display either a FAS in the caution mode, or a flashing amber light/rotating light. On the shoulder of a multilane highway, a FAS with the "Flashing Arrow" displayed shall be used if the work vehicle is on the traveled way. A changeable message sign may also be used.

If the vehicle encroaches into the traveled way, it shall be equipped as a shadow vehicle and operated in accordance with the guidelines in Section 8.11. If it encroaches into a freeway lane, the vehicle shall display a FAS in the arrow mode. If it encroaches into a two-way conventional highway, the FAS shall be in the caution mode, or display a flashing or rotating amber light.

8.12 MAZEEP (MAintenance Zone Enhanced Enforcement Program)

Caltrans coordinates with CHP to utilize officers on site at highway maintenance projects. MAZEEP is used to reduce the potential for traffic collisions, reduce traffic speeds to the posted speed limits, and to increase safety of the workers and motorists.

(A) RESPONSIBILITIES

- **Maintenance Area Superintendent** - or his/her designee, should make an assessment of the need for MAZEEP on projects that require the closure of traffic lanes with either cones or moving vehicles. The Superintendent may also identify specific Maintenance operations where the use of MAZEEP may be required.
- **Maintenance Supervisor** - is responsible to request MAZEEP services according to the interagency contract, and to provide clear and concise instruction/direction as to what duties the officer will perform and placement of CHP vehicle. These instructions will include worker and motorist safety concerns, traffic control procedures, and any anticipated traffic delays. This direction will be given prior to entering the work zone or at pre-job meeting.

Working in conjunction with the CHP, supervisors should discuss a contingency plan to be placed in effect should traffic delays beyond reasonable limits occur.

Supervisors are responsible for discussing, arranging, and/or providing communications with on-site officers. This may include hand-held radios, cellular phones, or the use of multi-agency scanners set to the appropriate frequencies.

Supervisors will work cooperatively with on-site officers to mitigate traffic delays caused by maintenance operations. Decisions to abate or discontinue work for traffic considerations shall be made collaboratively. Considerations shall be given to the type of work being performed, length of time until probable completion, and potential/probable exposure to personnel and additional traffic delays caused by resetting the traffic control system and reopening the work zone.

If the supervisor has made a timely request, and MAZEEP service is not available, the supervisor may use alternate methods to enable the work to proceed. Alternate methods may include additional advance warning signs/vehicles, changeable message signs, lookouts, and/or additional protective vehicles.

(B) UTILIZING MAZEPP ON FREEWAYS AND HIGHWAYS

Shall be requested for:

- All planned daytime or nighttime temporary closures of **ALL** lanes in the same direction of travel (full freeway closures).
- Planned night closures of two (2) or more lanes on a freeway with three (3) or more lanes of travel in the same direction.

Should be requested for:

- Any location/project that exposes workers on foot to moving traffic where escape routes are limited by median barriers, bridge rails, or similar structures and where additional physical protection is not deemed adequate.

May be requested for:

- Daytime closures of one (1) or more lanes on a full freeway or expressway
- Mobile work, e.g.; sweeping, striping, replacing pavement markers, etc.
- All other night work as deemed necessary by the supervisor.

(C) DETERMINING WHEN TO USE MAZEPP

Risk factors should be taken into consideration when determining when MAZEPP will be appropriate. Safety reviews conducted by the Superintendent and supervisor prior to the project (in the planning stages) may identify additional risks; if so, these risks must be considered in the decision making process. Some of these additional risk factors may include:

- Night maintenance activities that do not create an obvious work zone, such as replacing raised pavement markers or night sweeping operations.
- Maintenance activities that require a large number of vehicles or haul truck movements in and out of the work zone.
- Anticipated traffic queues that cannot be avoided.
- Working in locations where traffic has been flowing at high speed, free flow conditions for a significant period of time prior to the work zone (assistance may be required to reduce traffic speeds).
- Routes with high volumes of truck traffic and/or steep down grades.

When making the determination to use MAZEPP, be aware that overuse when conditions do not warrant may lessen its effectiveness in the future.

8.13 Planning Work To Reduce Worker Exposure

Supervisors shall plan work to minimize the amount of time employees are exposed to moving traffic. This can be done by choosing proper work methods, combining operations, avoiding high traffic volume periods, and utilizing MAZEPP (Maintenance Zone Enhanced Enforcement Program) and/or other devices designed to increase motorists awareness of the work zone.

Work methods and procedures should be designed to keep the amount of time workers are exposed to moving traffic to a minimum. For example, crews should be instructed to assemble in safe areas well away from the traveled way, convoy to the work site, and do their work expeditiously. Once work is completed, they should return immediately to a safe area.

In addition, when employees reach the work site, the work method should be designed to minimize the amount of time workers spend on foot near moving traffic. The first choice should be to use mobile power equipment to do the work. A worker in a piece of equipment is generally much safer than a worker on foot. The next choice of work methods would be to provide workers on foot with physical protection. For example, a barrier vehicle, guardrail, or some other obstacle can be used to provide physical protection. The last choice is to have workers on foot without physical protection. In this situation, the work method should be designed so that workers can face traffic whenever possible and can work apart as individuals and not in groups. If none of the above methods are possible, it may be necessary to have lookouts or a lookout alarm device or both. See Warning Systems - Lookouts, Section 8.17.

When a lane closure is planned, especially on freeways, managers and supervisors should contact all crews who could work within the closure. Good communication is a **MUST** in this situation. For example, along with roadway repair, stencil work, guardrail repair, electrical work, sign work, shoulder repair, sweeping, and landscaping can be completed. Not only will more work be completed, but also more protective vehicles may be available at the work site, providing workers with increased protection. In addition to Maintenance operations, managers should coordinate with District Traffic Operations, Surveys, and other district units for work needs within the closed lane. This approach will reduce employee exposure to traffic and the number of lane closures required for routine maintenance.

When planning combined operations, managers and supervisors shall also plan the work so that each employee has enough space to work safely. Refer to Crowding of Workers, Section 8.16.

Another opportunity to reduce worker exposure to moving traffic is to carefully plan work on the highway. When there are fewer vehicles on the traveled way, there are fewer vehicles with an opportunity to hit workers.

Managers and supervisors should consider reducing employee exposure by requiring an unconventional workweek or extended and/or multiple work shifts to take advantage of lower traffic volumes. Managers should also review maintenance projects for opportunities to improve worker safety with a complete facility closure.

Before short-term tasks are assigned, the supervisor will determine if the task has to be done immediately, or if it could wait. He/she shall decide if it could wait until formal traffic control will be set up, and the job performed as a part of a combined operation. An example would be the removal of litter from a median area. If the debris is not a safety hazard, could picking it up wait until a lane closure is set for another reason?

Supervisors shall plan all work operations to minimize the need for the backing of equipment and vehicles at the work site.

Although it is not mandatory, supervisors should conduct a post-job meeting with the crew and discuss what went right during the most recent operation, what went wrong, and how as a team we could improve our work practices in the future.

8.14 Working Near Moving Traffic

When working on or near the traveled way for any amount of time, workers must be aware of the hazards from errant vehicles. If available, a vehicle, regardless of its size, shall be used as physical protection from traffic. Workers on foot shall face traffic whenever possible. Always be aware of potential protective barriers such as guardrails, trees, or other natural obstacles that could be used to shield you from errant vehicles. If physical protection is not available, a lookout may be necessary (Refer to Warning Systems - Lookouts, Section 8.17).

Working on the shoulder of a highway requires the utmost caution and awareness. Employees have been killed or seriously injured being struck by errant vehicles leaving the traveled way. It is every employee's responsibility to be aware and watchful while performing work on the shoulder of any highway.

While working on the shoulder, it is imperative that you keep a vehicle or other means of physical protection between yourself and approaching motorists. Keep to an absolute minimum the time you stand or work at the rear of your vehicle.

While working or retrieving debris near or within a gore point, you must be keenly aware of the dangers traffic poses while entering and exiting the highway. The gore areas are decision points where motorists are normally paying attention to the task of either exiting the highway or merging with traffic.

Hazards exist primarily at two specific points; at the off ramp gore itself and on the right side of the on ramp gore point where motorists are usually looking over their shoulder or in the rear view mirror, not necessarily looking forward while preparing to merge with traffic.

For stationary operations in gore areas, ramp closures and barrier vehicles should be placed to ensure worker safety in addition to required lane or shoulder closures on the through lane. On and off ramps should be closed per Plate T-14 in Chapter 8. Barrier vehicles shall be parked across the ramp(s) to prevent traffic from going around the cones and signs. Special instances may require a deviation. If a deviation is required, please see Section 8.05 Changing Chapter Standards.

If you must work in a gore area for a short duration task, you shall use a barrier or shadow vehicle to protect yourself from oncoming traffic and have a lookout. For short duration tasks, it is recommended that you close the ramps or call for a California Highway Patrol traffic break before performing the work.

Traffic on two lane conventional highways is often lighter than on freeways. Workers cannot let this fact lull them into a false sense of security. When working on conventional two lane roads, employees shall be aware that errant vehicles can enter the work area from either direction. Many two-lane operations involve short duration work such as fixing guide markers, straightening signs, and litter removal. These operations involve workers on foot, often next to the traveled way. In these situations, employees must make sure that they use their eyes and ears to look and listen for danger signals to ensure their personal safety.

Employees shall wear proper warning garments as described in the Caltrans Safety Manual, Chapter 12. In addition to standard warning garments, employees who need extra visibility should wear ANSI Class III warning garments during the day and shall wear ANSI Class III warning garments at night.

8.15 Facing Traffic (Employees on Foot)

Supervisors shall plan and supervise the work to minimize the amount of time employees will have their backs to traffic. A lookout should be used during these times to protect the employees while their backs are turned to traffic.

Unless there is a clear reason for doing otherwise, employees shall continually face oncoming traffic while working on or near the traveled way. This is the personal responsibility of every worker.

Facing traffic is the most important thing you can do to protect yourself and your co-workers while working on or near the traveled way. Facing traffic gives you a better opportunity to see and hear errant vehicles. This allows you a chance to move out of the way and warn fellow workers.

8.16 Crowding of Workers

Supervisors shall plan work so that each employee has adequate space to work safely.

Supervisors shall ensure that employees know their responsibilities for positioning themselves so that each employee has enough work space to work safely and avoid being struck by flying material or another worker's tools.

Workers shall avoid "bunching up", which increases traffic exposure and causes public concern.

8.17 Warning Systems-Lookouts

While working on foot on or near the traveled way, employees should normally be protected by protective vehicles/equipment, guardrail, or other physical means. Where the absence of such physical protection exposes workers on foot to errant vehicles, a person shall be assigned as a lookout according to circumstances described below.

1. A lookout shall be assigned if **all** of these conditions exist:
 - (A) Work occurs on a roadway with a posted speed limit of 55-mph or more.
 - (B) Workers are without physical protection.
 - (C) Two or more people working close to each other.
 - (D) Working within 30 feet of moving traffic.
 - (E) A person is on foot.
2. A lookout is required for short duration work if a protective vehicle or other physical barrier is not provided.

The lookout shall continually watch approaching traffic for errant vehicles that may hit workers on foot. If trouble is suspected, the lookout shall warn the workers by yelling, using a vehicle or warning horn, a portable lookout alarm device, or any system capable of communicating the warning message. This warning is intended to give workers the time to use a planned escape route to avoid the errant vehicle.

A lookout shall not be assigned any other duties.

Lookouts shall be rotated often enough to keep them alert.

The supervisor may use a crew lookout whenever he or she thinks it is needed. Even if workers are physically protected, using a lookout may be beneficial.

Electrical and mechanical detection systems may be used to supplement the human lookout.

Slope watchers shall be used when working under unstable slopes where rocks may fall and injure workers. These slope watchers shall not be assigned to watch the slope and to lookout for traffic at the same time. Refer to the Maintenance Code of Safe Operating Practices, Slope and Embankment Maintenance, and Appendix E, Cut Slope Safety and the Caltrans Safety Manual, Chapter 21, Cut Slope Safety.

8.18 Parking

Before a vehicle is parked, the driver shall consider if the vehicle will be needed to perform the work. If not, the vehicle should be used for the physical protection of workers. If it is used for protection, refer to Section 8.11, Protective Vehicles. If it will not be used for physical protection or for work, the vehicle shall be parked where it will not affect passing traffic or interfere with the maintenance operation.

All vehicles should be parked on the same side of the highway (see Section 8.31, Maintenance Crews Working Across From Each Other).

If a vehicle is parked on the shoulder within 6 feet of a traffic lane on a multilane highway with a paved shoulder 8 feet or more in width for more than 20 minutes, then the shoulder must be closed as shown in Standard Plans T10. This is not necessary on city streets where parking is expected.

Whenever possible, enter or exit your vehicle on the side away from traffic, even though it may be harder to do so. This will reduce worker exposure. Avoid standing or working near the back or along the traffic side of vehicles. Also, workers should avoid working directly in front of vehicles due to the danger of roll ahead if struck.

8.19 Signs

Advance warning signs shall be placed when a stationary operation is on the traveled way, or is on the shoulder within 6 feet of a traffic lane on a multilane highway with a paved shoulder 8 feet or more in width. Also, warning signs shall be placed well in advance of the work, when traffic slows, changes lanes, or moves from its normal course of travel because of the work. The standard signs shown in MUTCD and CA Supplement (Part 6) and in Standard Plans T10 through T17 shall be used.

Portable signs should be placed on sign standards with two (2) or more orange flags. The sign standard shall be in an upright position with the center of the sign panel a minimum of 5 feet above the pavement. A cone shall be placed next to each warning sign. If portable signs are displaced or overturned during the work, they shall be immediately replaced. Portable signs shall be held in position with approved weighing devices only.

Use your vehicle to protect yourself from traffic while setting and retrieving warning signs. A shadow vehicle should be used for setting and retrieving warning signs for freeway lane closures. A shadow vehicle shall be used as a protective vehicle during the installation and retrieval of traffic cones and signs in the taper and tangent sections of a lane closure.

When work is temporarily stopped or finished and traffic is not affected, all signs shall be promptly removed, dropped down, or turned away from traffic. Using signs when they are not needed reduces their effectiveness. In addition, installing them when they are not needed increases worker exposure to traffic.

Extra warning signs may be used when appropriate. For example, if queues are expected to develop in lane closures with reversible control, extra W3-4 “BE PREPARED TO STOP” signs can be used.

Placing an advance warning sign, such as a W20-1 “ROAD WORK AHEAD” sign, on the rear of a vehicle in the actual work area does not provide adequate warning to traffic, and is not permitted. However, an advance warning sign may be used on an advance warning vehicle.

Signs on vehicles with messages such as “WARNING – THIS TRUCK MAKES FREQUENT STOPS” are advisory only and do little to protect the workers. They should only be used on low speed roads or city streets. When this type of sign is used, an amber light or FAS in the caution mode shall be used along with it.

Signs, such as W8-7 “LOOSE GRAVEL”, W21-2 “FRESH OIL”, etc., may be placed on barricades. The barricades shall be ballasted either internally or by means of sandbags placed on the lower parts of the barricade frame or stays. The sandbags shall not be placed on top of the barricade or, over any retroreflectorized barricade rail facing traffic.

8.20 Flagging Operations

Any time two-way traffic must share the same lane because of work in the other lane; a flagging operation must be set up. See Standard Plan T13.

Flaggers shall receive on-the-job training before going on duty and shall follow the flagging procedures described in Chapter 6C Temporary Traffic Control Elements and Chapter 6E Flagger control of the MUTCD and the CA Supplement. Flaggers will receive training and instructions based on the MUTCD and the CA Supplement and work site conditions that also includes the following:

- (1) Flagger equipment which must be used.
- (2) Layout of the work zone and flagging station.
- (3) Methods to signal traffic to stop, proceed, or slow down.
- (4) Methods of one-way traffic control.
- (5) Trainee demonstration of proper flagging technique and operations.
- (6) Emergency vehicles traveling through the work zone.
- (7) Handling emergency situations.
- (8) Methods of dealing with hostile drivers
- (9) Flagging procedures when a single flagger is used (when applicable).

The training needs to be documented.

Flaggers should be rotated and relieved periodically to maintain alertness.

Flaggers shall wear ANSI Class III warning garments. Additionally, flaggers shall stand where they are most visible to approaching traffic and avoid areas of shade, shadows, etc., whenever possible.

On some two-lane roads one flagger may be used to control traffic. Traffic volume must be light and the length of the one lane section should be short so that one end is visible from the other. The sight distance for approaching vehicles must be long enough that traffic can be safely controlled from one end of the work zone. This method must be approved by the supervisor.

The cones on the centerline shown in Standard Plan T13 may be eliminated at the supervisor's discretion if a pilot car is used or an approved deviation is in place (See 8.05). The pilot car shall have radio contact with personnel in the work area and the maximum speed of the pilot car through the traffic control zone shall be 25 miles per hour.

The minimum distance required between the flagger and the work area is listed in Table 1, Standard Plan T13.

Flaggers shall be used when the drivers vision is impaired because of smoke or dust in work zones. They shall also be used to protect trucks that must turn on the traveled way to load or dump. The flagging procedures in Chapter 6C Temporary Traffic Control Elements and Chapter 6E Flagger Control of the MUTCD and the CA Supplement shall be followed.

Where the end of a one-lane section is not visible from the other end, the flaggers shall use 2-way radios or other positive means to maintain control of traffic.

Except for unusual circumstances or emergencies, flaggers should not be used on freeways.

Traffic signals may be used to control traffic on two lane roads. The operation must conform to Chapter 4D Traffic Control Features of the MUTCD and the CA Supplement. Attention is directed to Figures 6H-12 and 6H-14 of the CA Supplement.

8.20.1 Handling Emergencies Within the Work Zone

Warning signal for crew at the work area

Prior to going out on the job, crews shall establish a warning signal for the work area crew in case of an emergency.

Emergency vehicles

Supervisors shall ensure that all crew members are aware of the procedures to be used whenever emergency vehicles approach the flagger's station. Supervisors should also discuss emergency procedures with local law enforcement agencies, ambulance services, and fire departments.

When certain types of work, such as blasting or extensive excavation makes the roadway impassable, advance arrangements should be made with the local police agency who has jurisdiction over the roadway.

When informed in advance of an approaching emergency vehicle, the flagger should clear an unimpeded path for the emergency vehicle by stopping traffic from all directions.

When no advance notice is given, first stop the emergency vehicle, and then stop all traffic including construction equipment to provide a clear path for the emergency vehicle to pass.

Violations of traffic control and hostile drivers

Flagger should warn the workers that a driver has run the flagger station. Stop all vehicles entering the work area, but do not put yourself in an unsafe situation. Plan your escape route before an emergency occurs.

When dealing with hostile drivers, be courteous and professional. Do not get involved in an argument with motorists or pedestrians.

If a motorist fails to follow your instruction and threatens the safety of the work area, or is hostile, note the vehicle license number and description of the vehicle and driver. Report the information to your supervisor for the purpose of filing a police report.

Collisions in traffic control zone

Flaggers must know how to handle collisions in traffic control zone and be prepared for emergency flagging operations.

In the event of a traffic collision, notify your supervisor and call for help.

If a collision happens in the line of waiting traffic, stay at your station and continue to control traffic until you receive instructions from your supervisor or a police officer.

If a collision happens within the controlled area, hold approaching traffic and follow instructions from the supervisor, the leadworker, or from a police officer.

8.21 Shoulder Closures

Working on the shoulder of a highway requires caution and awareness. Employees have been killed or seriously injured being struck by errant vehicles leaving the traveled way. It is every employee's responsibility to be aware and watchful while performing work on the shoulder of any highway.

While working on the shoulder, keep a vehicle or other means of physical protection between yourself and approaching motorists. Do not stand or work at the rear of the vehicle at any time.

Shoulder closures are used to guide motorists around stationary operations on shoulders. A shoulder closure is optional on unpaved shoulders and two-lane roads. It must be kept in mind that shoulder closures provide no physical protection.

A shoulder closure is required for a stationary operation on a multilane highway with a paved shoulder 8 feet or more in width whenever vehicles or equipment are parked on the shoulder within 6 feet of a traffic lane. Shoulder closures are to be set up as described on Standard Plans T10.

For Short Duration shoulder operations of 20 minutes or less, signs/channeling devices may be eliminated if a protective vehicle with activated flashing amber light is used.

Shoulders used as part time lanes should be closed in the same way as lanes are closed.

A properly placed barrier vehicle shall be used with shoulder closures to protect workers.

8.22 Moving Lane Operations/Closures

Before employees work in a moving lane closure, a discussion shall be held so that all involved employees will know what their role in the operation is and how to proceed safely.

In any slow moving operation the first vehicle in the lane approached by motorists shall be a shadow vehicle.

For information on vehicle spacing, vehicle positioning, and signing, refer to the Traffic Control System For Moving Lane Closure On Multilane Highways (Standard Plans T15 and T16) and on Two Lane Highways (Standard Plan T17).

All vehicles used as shadow trucks shall be equipped as defined in Section 8.11, Protective Vehicles. Radio communication in all vehicles is required.

Other requirements for moving lane closures and shadowing moving operations, found in the Maintenance Code of Safe Operating Practices, shall be followed.

Exceptions to this rule are tow trucks and snow/rock removal/de-icing equipment.

8.23 Lane Closures

A lane closure shall be set if a stationary operation takes more than 2 feet or reduces the width to less than 10 feet of an existing lane on a multilane highway. To take up to 2 feet of a lane on a multilane highway without a lane closure, a cone taper shall be installed that begins at least 300 feet upstream from the work area. The taper shall have 28 inch cones spaced 50 feet apart.

The lane of a two-lane highway shall be closed if work reduces the width of a lane to less than 10 feet. Traffic shall not be moved across the center stripe without a lane closure or other means of traffic control.

A space of 6 feet should be maintained, whenever possible, between moving traffic and the work area. When closing a lane, a barrier vehicle or a shadow vehicle shall be used for the installation of the signs and the FAS if they can be placed while off the traveled way on the shoulder or median. A shadow vehicle shall be used as the protective vehicle during the installation and retrieval of traffic cones and signs in the taper and tangent sections of the lane closure. All devices placed in areas with no shoulders from an open lane require the use of a shadow vehicle for protection.

Lane closures shall be placed according to the Standard Plan T10, Traffic Control System for Lane Closure on Freeways and Expressways or the Standard Plan T11, Traffic Control System for Lane Closure on Multilane Conventional Highways.

If a lane closure begins to cause traffic to back up (commonly called queuing), the advance warning signs shall be moved back in advance of queuing, or portable changeable message signing (PCMS) shall be placed and maintained in advance of the upstream end of queuing. If the signs cannot be moved back, or the use of a PCMS cannot be employed, the lane closure should be removed. If the lane closure results in a significant traffic delay, the closure may need to be removed.

A PCMS may also be used to redirect traffic and relieve queuing. The additional PCMS may be used at key interchanges and exit ramps and other locations where traffic queues may be expected due to maintenance activities.

A Changeable Message Sign (CMS) may also be used to redirect traffic and relieve queuing.

If for some reason, a lane cannot be closed utilizing the requirements of this section, a deviation may be warranted. See Section 8.05, Changing Chapter Standards.

8.24 Closing Auxiliary Lanes

Work occurring at the beginning of an auxiliary lane such as a truck lane or lane added to increase capacity, will require as a minimum, the shoulder closure plan shown on Standard Plan T10 plus these additional requirements:

- (A) A W20-1 “ROAD WORK AHEAD” sign instead of the W21-5b “SHOULDER WORK AHEAD” sign on the shoulder upstream from the beginning of the auxiliary lane.
- (B) Cones on the shoulder stripe from the W20-1 sign continuously to the auxiliary lane line.
- (C) A C30 (CA) “LANE CLOSED” sign in the closed lane about 100 feet from its beginning and every 2,000 feet after that.

If the work site is a considerable distance from the beginning of the auxiliary lane and the above method is not practical, the lane shall be closed according to the Standard Plan T10. If the auxiliary lane is located at an exit ramp or connector, the closure plan in Standard Plan T14 shall be used.

8.25 Standard Exceptions to Lane Closure Procedures

(A) Limited Work on the Traveled Way, Without Lane Closures.

Short-Duration operations may be conducted on the traveled way without using a lane closure or signs. Pothole patching and debris retrieval, are examples of brief operations. To use this method all of the following conditions must exist:

- (1) The traffic volume must be light. This means the worker can walk from the shoulder to the site on the traveled way, do the job, and walk back to the shoulder without interfering with traffic.
- (2) Sight distance shall be at least 500 feet in each direction. Where 500 feet of sight distance is not available at the work site, one or more lookouts should be posted to extend visual coverage if necessary.
- (3) Vehicles must be parked completely off the traveled way.

If all three of these conditions exist, the supervisor may instruct workers to perform the work on a specified section of highway without a lane closure. All of the following work methods shall be used:

- (a) When the crew consists of at least two (2) workers, one (1) of the workers shall act as a lookout. The lookouts exclusive duty will be to continually watch for approaching traffic and to warn the worker whenever trouble is suspected.
- (b) The lookout shall not carry a flag or paddle and shall do nothing to control or influence traffic. All workers shall be off the traveled way when traffic passes.
- (c) Only one (1) production worker shall be on the traveled way, unless more are needed to reduce the exposure time.
- (d) Workers shall face approaching traffic whenever possible.
- (e) Workers shall have a planned escape route.

- (f) A FAS in the caution mode or a flashing amber light shall be operating.
- (g) W20-1 “ROAD WORK AHEAD” signs are not required, since passing traffic is not to be affected.

(B) Pavement Marking and Relamping Operations

A supervisor may allow pavement marking and relamping operations on the traveled way without a lane closure. The posted speed limit must be less than 55 miles per hour and the work must take less than 20 minutes to complete. The supervisor may also use devices such as signs, barrier vehicles, and lookouts to increase worker protection.

(C) Chain Controls

Lane closures are not required in chain control operations. However, on multilane highways, they may be used to create a cushion between Caltrans workers and fast vehicles leaving the work area. In addition, a supervisor may use lookouts and barrier vehicles to increase worker protection.

(D) Moving Shoulder Operations

The supervisor may allow moving shoulder operations next to the traveled way without a lane or shoulder closure. Shoulder grading, mowing, and spraying operations are examples of moving shoulder operations. The work must leave at least 10 feet of the lane next to the shoulder open to traffic. On two-lane conventional highways, traffic shall not be moved across the center stripe without a lane closure or other means of traffic control.

8.26 Flashing Amber Lights and Rotating Amber Lights

Amber lights shall be used to alert motorists to work activity near, but not on, the traveled way. Amber lights are not to be used while driving at prevailing speeds, when parked in an established lane closure, or when no danger to the employee or motorist exists.

Warning lights, to be effective, must only be used when they are needed.

Flashing Amber Light includes such devices as flashing lights, rotating beacons, or light/stick bars.

Flashing and/or rotating amber lights are to be used on motor graders, snow removal equipment, and other specialized equipment that are operated on the traveled way at lower than prevailing traffic speeds.

Flashing amber/rotating lights are to be used on pilot cars not having a FAS. A flashing amber light should not be used at the same time as a flashing arrow sign because the arrow becomes more difficult to read. If the vehicles are equipped with both, do not use at the same time. During the hours of darkness, or during periods of inclement weather, amber lights should be used with discretion. At times, the vehicle emergency flashers may be more effective.

8.27 The Use of the Flashing Arrow Sign (FAS)

Arrow messages pointing left, right, or to both sides, are to be used as action messages. An arrow is to be used only when requiring the motorist to change lanes. An arrow message is not to be used when a vehicle is parked in a closed lane unless it is being used for the arrow closing that lane.

The terms "arrowboard" and "flashing arrow sign" are synonymous. The Type I is approximately 8 feet x 4 feet , trailer mounted FAS. The Type II is approximately 6 feet x 3 feet , vehicle mounted FAS. Flashing Arrow Signs have several modes. The caution mode has four lights flashing and the arrow modes flash right or left.

A FAS in the arrow (ALL lamps forming the arrowhead and shaft shall flash on and off simultaneously) or chevron mode may be used for stationary or moving lane closures. During hours of darkness, the FAS shall be dimmed to prevent blurring of the arrow image.

To alert the motorist to work activity near, but not on the traveled way, the caution mode of the FAS is to be used.

Any shadow vehicle working on the traveled way of a multilane highway outside of a lane closure must be run with a FAS board in an arrow mode.

Work vehicles that are being shadowed should usually not display a FAS. Two partially superimposed FASs may not give a clear message.

8.28 Placing the Flashing Arrow Sign (FAS)

The flashing arrow sign (FAS) should be placed on the shoulder at the beginning of the taper as shown in Standard Plan T10. If there is no shoulder, the FAS should be placed as close to the beginning of the taper as possible. A minimum 1500 feet of sight distance shall be provided where possible for vehicles approaching the first FAS.

If the FAS cannot be located properly, consider placing the taper in a different or safer location.

In multilane closures on freeways and expressways (Standard Plan T10), one FAS must be used for each lane closed. The first FAS used shall be a Type 1. The second and succeeding FAS may be either a Type 1 or Type 2.

8.29 Working Equipment Against Traffic

Operating equipment against traffic is permitted when working on the shoulder or within a lane closure. This may be desirable in some cases, such as during crack sealing operations, where employees would have the added protection of the work vehicle between themselves and approaching traffic. Headlights shall be turned on during the daylight hours when working against traffic. They should be turned off at night when working against traffic, because they might confuse motorists.

8.30 Access to Median Work Zones

- (A) Workers should not walk across traffic lanes to work in median areas. They shall drive into the median area and park when possible. However, the width and condition of the median must be considered. If the area is too narrow, wet, sandy or is difficult to accelerate from, it should be avoided.
- (B) If it is not possible to park in the median area and crossing on foot is necessary, the following rules must be followed:
 - (1) Workers shall not run. They shall wait for a break in traffic adequate to allow them to walk across the lanes.
 - (2) Workers shall not carry tools or items that would slow them down and make the crossing unsafe.
 - (3) If the traffic is too heavy and a traffic break is not available, workers shall wait for a safer time to do the job. If they must cross, they shall call for traffic control or ask for a CHP traffic break.

8.31 Maintenance Crews Working Across From Each Other

Maintenance crews shall not work on opposite sides of a highway, directly across from each other.

The intent of this guideline is to prevent the channeling of vehicles traveling in the same direction on a freeway or causing vehicles to cross the centerline of a two-lane highway.

Crews shall not perform work directly across from each other on opposite sides of a highway unless there is a median barrier or other divider. (For example, tree crew in shoulder closure working directly across from crew in the #1 lane). A distance of at least 2,000 feet must be kept between operations if work must be accomplished at the same time.

However, if flaggers, stop signs, or traffic signals positively control the traffic, the work sites can be closer.

NOTE: This applies to stationary operations and not when a moving operation, such as sweeping, striping, or spraying, temporarily passes a stationary operation.

8.32 Picking Up Litter and Debris

Normally, the safest way to pick up litter is to work individually and always face approaching traffic. Trucks should be parked away from the work area unless needed to provide protection from traffic. The workers may be dropped off and picked up later. The practice of employees walking beside a truck loading litter with a pitchfork or other hand tool should be avoided.

In narrow medians, protective vehicles may be necessary at both ends of the work area.

Litter bags should not be filled so full that they are too hard to lift. The bags should be placed where workers can easily pick them up with minimum exposure to traffic. When possible, the bags should be stockpiled to reduce the number of stops needed for bag removal.

Do not place hypodermic needles in litter bags. For more information, refer to the special instructions for the Disposal of Hypodermic Needles in the Maintenance Code of Safe Operating Practices. Other sharp objects, heavy metal objects, tire caps, or concrete chunks should not be placed in litter bags. These items could seriously injure the person who picks them up.

When retrieving debris from a freeway lane, workers shall wait for a break in traffic. A break in traffic is defined as all lanes clear of traffic long enough for the employee to walk out, retrieve the debris, and walk back to the shoulder. If no traffic breaks occur, contact the CHP to provide one.

Workers shall not try to flag traffic, use hand signals, or otherwise attempt to create a traffic break.

When debris is retrieved from the traveled way, workers shall follow these guidelines:

- (A) Workers shall remain in the vehicle until the traffic break approaches.
- (B) An escape route shall be planned before leaving the vehicle. The vehicle shall not be parked where it will block the workers' escape route.
- (C) When workers are on foot, their vehicle shall be kept between themselves and approaching traffic. Workers shall walk on the outer edge of the shoulder, staying as far from moving traffic as possible.
- (D) Workers shall always face approaching traffic.

The above procedures, except the traffic break, should be followed when removing debris from shoulders.

8.33 Night Work

Extra caution is necessary at night when both motorist and worker visibility is reduced.

Each employee must be informed about the hazards of working at night. Careful planning is necessary, and all the potential problems that may be encountered while working on or near the traveled way should be considered. The use of MAZEPP will enhance the protection of workers in lane closures.

During the hours of darkness, workers on foot must wear the proper warning garments as described in the Caltrans Safety Manual, Chapter 12, which includes ANSI Class III warning garments.

The rain gear jacket shall be ANSI Class III compliant for nighttime wear. Reflective material may also be worn on hard hats.

Sufficient light should be provided at the work site. Light plants, floodlights, or work lights shall be mounted and directed in a manner to allow employees to work safely and to prevent glare to approaching traffic.

Because of the risk to workers, nighttime call outs should be kept to a minimum. If there is no danger to the public, environment, or roadway, repairs should wait until the next day. For example, if the damaged facility does not encroach on paved shoulder areas or is more than 3 feet from the traveled way in unpaved shoulder areas, there should not be a nighttime call out except to place barricades. It is up to the supervisor to decide when it is appropriate to call out a crew for quick, temporary repairs, or to wait until daylight.

Call outs should be made when warning or regulatory signs have been knocked down and pose immediate danger to the motorist. Also, supervisors should consider responding at night for broken water lines, damaged phone or electrical lines, or spills where environmental damage may occur.

Each district will advise all local law enforcement agencies of this call out policy.

During nighttime lane closures, all traffic cones shall be retroreflective as described in Chapter 6F of the MUTCD and the CA Supplement.

All warning signs used at night shall be made with high performance retroreflectorized sheeting.

During hours of darkness, the lights on the Flashing Arrow Sign shall be dimmed to prevent blurring of the arrow image.

8.34 Transportation of Workers

Workers shall be transported in vehicles equipped with seats and seat belts. Workers shall not be allowed to ride in the beds of dump trucks, buckets of loaders, on the sides or running boards of vehicles, or any other place on a vehicle or equipment that was not designed for driving or riding.

8.35 Operating Maintenance Equipment

Employees must be properly licensed, trained, and qualified prior to operating equipment unsupervised. META (Maintenance Equipment Training Academy) guidelines for the Qualification Program are available in the Division of Maintenance web pages. District META coordinators may be contacted for assistance in locating the nearest Qualifier or Trainer.

8.36 Backing of Vehicles and Equipment

Backing accidents have always been the most prevalent type of vehicle accident. Because so many of the tasks Maintenance employees perform involve the backing of vehicles and equipment, the potential for serious accidents exists, and extra emphasis must be placed on preventing their occurrence.

Methods to avoid backing accidents should be discussed at regularly-scheduled crew tailgate safety meetings. Any close calls that occur should be discussed, along with ways to prevent a recurrence.

A. Prior to Job/Planning the Work

- 1) Supervisors should plan work projects to minimize the need for backing of vehicles and equipment whenever possible. For example, the forward mode of cone retrieval should be utilized for retrieving lane closures.
- 2) Design the work space to eliminate or decrease backing and blind spots; when feasible pull trucks into the work zone and let the operation catch up to them.
- 3) At tailgate safety meetings, prior to the job, discuss how and when vehicles will be backing within the work zone and specific measures that will be taken to prevent an accident.

B. Safety at the Worksite

- 1) Workers on foot will be separate from equipment as much as possible: ensure that employees on foot stay out of the work area and in clear view of those who are operating equipment.
- 2) Minimize the distance heavy equipment needs to back up in order to gain access to the work area.
- 3) Employees should never move equipment without making positive visual contact with any workers on foot around or near the equipment.
- 4) In work zones where moving equipment has the potential to strike a worker on foot, employees shall not place themselves in or near the path of backing vehicles and should not enter the work area until it is clear for hand work. One person should be designated as a lookout while vehicles/equipment are moving within the work area.

- 5) Every backing situation is new and different. Even if you work at the same location several times a day, you should be watchful for changes and any new obstacles.
- 6) Use a spotter. The driver and spotter should use hand signals instead of verbal ones and make sure they understand each other's signals. Don't have the spotter walking backwards while giving instructions.
- 7) During shoulder or pavement rolling operations, make sure all workers on foot are clear of the work area before moving any vehicles/equipment.

C. Personal Responsibilities

- 1) Employees operating vehicles and equipment must be familiar with the blind spots for the particular equipment they are operating. Remember that mirrors can never give the whole picture while backing.
- 2) Train workers on foot and equipment operators in appropriate communication methods (e.g., using hand signals and maintaining visual contact) to be used when workers on foot are required to be in the same area as equipment.
- 3) Do a walk-around of your vehicle before entering. Check for obstructions, low-hanging trees and wires, and any other potential clearance-related problems.
- 4) On-foot personnel need to make sure they are a safe distance from vehicles in the work area. Do not stand where the operator cannot see you; a vehicle that has the potential to back up could run you over.
- 5) Although a flagger's primary job is to control traffic, they could assist workers on foot by acting as an additional lookout at the jobsite.

D. Working with Vendors/Contractors

- 1) When working with others who may not be a part of your crew, you must realize that their safety practices and procedures may be different than ours. This becomes especially important when vendor vehicles are backing within your work zone.
- 2) Discuss backing procedures and practices with the affected personnel/vendors before the job begins, if possible. If not, use extra caution when vendor vehicles enter the work area.

- 3) Make sure that vendor trucks and equipment operating in your work area have functioning back alarms. If they don't have a back alarm or it isn't working properly, tell your supervisor immediately, tell your co-workers, and also advise the driver.
- 4) If possible, designate a lookout to monitor vendor truck movements, especially if the task involves backing into an asphalt paver, backing from a staging position, or similar activity where employees are on foot in the work zone.

8.37 Working on Machinery and Equipment

Workers shall not work on electrical or mechanical equipment unless they are properly trained and authorized by their supervisor to do so.

Every power driven machine equipped with lockable controls or readily adaptable to lockable controls shall be locked out or positively sealed in the "off" position during repair, servicing or adjusting work. Machines not equipped with lockable controls or readily adaptable to lockable controls shall be de-energized or disconnected from its source of power. In all cases, accident prevention signs and/or tags shall be placed on the controls of the machines during repair work.

No one shall remove the tag or unlock the switch except the person who placed it.

During repair, machines or equipment shall be effectively blocked or otherwise secured to prevent accidental movement if such movement can cause injury to employees. For example, before working underneath any vehicle and/or equipment to adjust or inspect it, steps shall be taken to ensure that the vehicle cannot move. Shut off the engine, set the brakes, and physically block the wheels with wheel chocks before any work begins.

Remove the keys from the vehicle and place a "Do Not Operate" tag in the ignition switch, on the steering wheel or some other very visible location. When working on a motor grader or other equipment that has implements such as blades, plows or buckets attached, you must lower them to the ground or block and/or chain them up before working underneath them.

Never get under a vehicle or equipment supported only by a jack or held up only by the equipment's lifting system. Use an approved safety stand or other device designed to support the load. Do not use makeshift or homemade devices or unstable materials.

Do not work under a raised dump bed or other raised vehicle bed, unless the safety stand is in place. Raise the bed, place the stand in its holder and lower the bed onto the stand before beginning the work.

Depressurize air and hydraulic hoses before working on them. Do not search for hydraulic leaks with your hands; use a piece of wood or cardboard. Hydraulic fluid or air under pressure could enter your skin and cause serious injury.

Bleed pressure on spray tanks before opening or working on them. This includes chemical spray tanks, emulsion tanks on trucks or trailers, and even Hudson-type pump sprayers.

Before adjusting, cleaning, or repairing brush chippers, read the operators manual and take steps to ensure that all potential energized parts have been locked out. This includes the guillotine guards on those so equipped and all parts of the rotating drum.
Do not operate equipment or machinery without the required guards or shields in place.

During adjusting or cleaning operations, never reach into the operating equipment. Use an extension tool or other means of removal if necessary—not your hands.

This information is provided to help employees comply with the General Industry Safety Orders, Section 3314, Cleaning, Repairing, Servicing and Adjusting Prime Movers, Machinery and Equipment.

8.38 Tailgates of Trucks

Each year, employees are injured (smashed fingers) removing debris or rocks from dump truck tailgates. Do not use your hands or fingers to clear debris from the tailgates of dump trucks. Use a shovel, digging bar, or other tool to remove debris.

8.39 Compressed Air

When using compressed air, always wear safety glasses.

Never use compressed air to transfer liquids from one tank to another unless tanks are designed for such service.

At no time shall compressed air be directed toward a person. When compressed air is used, all necessary precautions shall be taken to protect persons from injury. Do not use compressed air to “blow down” clothing or skin. Compressed air nozzles must be of the safety type that limits pressures to 10 psi or less.

Tanks or drums not designed for use as compressed air tanks shall not be filled with compressed air.

Air hoses shall be checked regularly to ensure that they are in good condition. Cracked or leaking hoses shall be removed from service and replaced. Compressed air tanks should be checked and drained weekly or more often if conditions warrant.

Compressed air-tank operating permits should be conspicuously displayed and kept current. Air tanks shall be inspected as required by the Unfired Pressure Vessel Safety Orders, 8CCR Section 461.

All compressed air equipment and plumbing shall meet the requirements of the Unfired Pressure Vessel Safety Orders.

Compressors that start automatically require a warning sign.

8.40 Work On Electrical Circuits

Only qualified and trained persons shall work on electrical equipment or systems. All work performed directly on or in proximity to electrical installations, equipment or systems operating or intended to operate at 600 volts or less shall comply with the Low Voltage Electrical Safety Orders. All work performed on systems operating at more than 600 volts shall comply with the High Voltage Electrical Safety Orders.

The Codes of Safe Operating Practices for work performed on electrical equipment or systems contain more information on the specific hazards and on the proper safety procedures to follow while performing the work. Never work on energized electrical systems unless you are properly equipped and trained to do so.

This section does not apply to installations of conductors and equipment in vehicles operating at less than 50 volts, or to their ignition systems.

Clothing and Personal Protective Equipment for Caltrans Electricians and other Caltrans employees working on electrical systems

The standard clothing for Caltrans electrical workers shall be (shirts, pants, coveralls, etc) flame retardant, and a minimum arc-flash rating of 8 cal/cm² (meeting ASTM F1506 requirements and tested according to ASTM F1959). Shirts/coveralls shall be long sleeve, and be able to close at the neck. Short sleeve shirts are not allowed for electrical workers. Leather work boots are required at all times.

Jackets, parkas, rain wear, and other outer garments shall also be flame retardant and rated for a minimum arc-flash rating of 4 cal/cm².

It is recommended that clothing and undergarments (worn under the arc-rated clothing layer) be constructed of fabrics that are either naturally flame resistant or treated to be flame resistant, with only enough synthetic fibers and/or elastic to provide support.

Care and cleaning of this clothing (standard and outer) shall be as recommended by the manufacturer, and not interfere or degrade the flame resistance or arc flash rating of the clothing. The employees shall inspect clothing after every washing and report deficiencies to the supervisor.

In addition to the standard worker protective clothing, Caltrans electrical workers that routinely work on or near energized systems (of over 50 volts to ground) are required to have the following personal protective equipment (PPE) on hand at all times:

- flame retardant reflective vest (meets ANSI Class 3 requirements for reflective clothing).
- insulated gloves w/leather protectors (compliant with ASTM D 120, and ASTM F 696), rated for 500 volts (minimum).
- clean leather work gloves
- arc-rated face shield (minimum arc-flash rating of 8 cal/cm²)
- arc-rated hood sock (or balaclava) (minimum arc-flash rating of 8 cal/cm²)
- insulated hand tools (compliant with ASTM F 1505)
- lockout-tagout device and personal lock. (The employee and employee's supervisor or designated leadworker shall be the only ones to have keys to the lock at the worksite).

The employee must have this clothing and equipment available at all times when at work. Reporting to work without this clothing and equipment may be grounds for the supervisor to initiate corrective action. Employees are responsible for notifying the supervisor of any damage or deficiency in the assigned PPE as soon as possible, and by the end of that day or shift.

PPE shall be inspected at every safety tailgate meeting. Documentation of inspection may be required. During the inspection, deficiencies shall be noted and replacement equipment shall be ordered and/or provided.

Additional PPE shall be provided on a need basis. High voltage equipment shall be in excess of the equipment listed above.

Additional Requirements:

Leather Gloves

The following requirements are for leather gloves used in electrical work for energized systems under 250 volts. The use of leather gloves and insulated tools exceed the California Electrical Safety Orders for energized systems 250 volts and under.

- leather gloves shall be of all leather construction
- leather gloves shall extend at least two inches beyond the end of the sleeve.
- leather gloves shall be clean and dry.
- leather gloves that have been contaminated shall be replaced. Contaminated gloves may be used for other uses (not around energized electrical systems).

Insulated Tools

- insulated tools shall be used on all energized systems.
- insulated tools shall conform to ASTM F 1505
- insulated tool kit shall consist of a minimum of: (a minimum of eight tools)
 - lineman pliers
 - needle nose pliers
 - diagonal wire cutters
 - Philips #1 and #2 screw drivers
 - slotted 3/16 and 1/4 screwdrivers
 - wire stripper

8.41 Working Near Utilities

(A) Overhead Utilities:

Workers shall not be required or permitted to perform any function in proximity to energized high voltage lines. Any activity where any parts of tools, machinery, or materials that an employee is touching or any part of an employee's body will come closer than the minimum clearances from energized overhead lines set forth in the following table is prohibited. Employees who work in proximity to or will come within the clearances of the table of any overhead lines will be trained in the hazards and identification of types of overhead lines. If lines are low voltage (less than 600 volts) a

minimum clearance of 3 feet will be maintained at all times unless lines are de-energized and grounded. All overhead lines will be considered energized unless de-energized and grounded at the site by the utility operating the line.

Boom equipment must not be operated where the boom could come within the minimum required clearance set forth in this table. Hoisting over energized lines is prohibited.

Nominal Voltage (Phase to Phase)	Minimum Required Clearance (Feet)	Minimum Required Clearance (Meters)
600 50,000	10	3
Over 50,000 75,000	11	3.4
Over 75,000 ... 125,000	13	4
Over 125,000 ...175,000	15	4.6
Over 175,000 ... 250,000	17	5.2
Over 250,000 ... 370,000	21	6.4
Over 370,000 ... 550,000	27	8.2
Over 550,000...1,000,000	42	12.8

Figure 8-2: Overhead Utilities

If downed power lines are located, workers shall not try to move or repair them. They shall stay clear and call the experts; normally, the local power company will respond.

(B) Underground Utilities:

Before any digging or excavations are begun, the area shall be checked to determine if there are any buried utilities. Some examples of digging or excavations requiring checking would be installing a new sign post, guide marker, snow pole, shoulder grading or ditch/culvert cleaning.

Utility markers or buildings that have no above ground source of power can indicate underground utilities. If the excavation will be conducted in an area which is known, or reasonably should be known, to contain subsurface installations, only hand tools shall be used for digging.

The Superintendent or supervisor shall notify the appropriate Regional Notification Center for operators of subsurface installations at least two (2) working days, but not more than 14 calendar days, prior to commencing any excavation with power tools.

The Regional Notification Centers include but are not limited to the following:

<u>NOTIFICATION CENTER</u>	<u>TELEPHONE</u>
Underground Service Alert Northern California (USA)	1-800-642-2444
Underground Service Alert Southern California (USA)	1-800-422-4133

If the excavation will be conducted in an area which is known, or reasonably should be known, to contain Caltrans electrical facilities, the Superintendent or supervisor shall notify the Electrical Supervisor for the area, prior to commencing any excavation.

In all cases, location of underground utilities, or a clearance, will take place before excavation or digging begins.

8.42 Ladders

Ladders shall be maintained in good condition at all times. The joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

Metal ladders shall not be used while working on electrical equipment. All metal ladders shall be marked with a sticker or stencil that clearly says: "Caution–Do Not Use Around Electrical Equipment."

Supervisors shall periodically inspect ladders for wear and damage. All ladders shall be cleaned of oil, grease, or slippery materials. Ladders which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as 'Dangerous, Do Not Use'.

When using ladders, always face the rungs and use both hands. Do not carry materials or equipment while using a ladder.

8.43 **Confined Spaces**

Workers need to be aware of confined spaces and their hazards.

A confined space is any enclosed location where:

- (A) An employee can physically enter, **and**
- (B) Has limited or restricted means of entry or exit, **and**
- (C) Is not designated for continuous employee occupancy.

For Caltrans employees, confined spaces include enclosed locations such as tanks, sumps, drain inlets, bridge cells, shafts, pits, bins, tunnels, tubes, pipelines, trenches, vaults, vats, pump houses or compartments, sewage lift stations, culverts, or similar type enclosures. No person will be allowed to enter a confined space unless all workers involved have been trained in the hazards, operating and rescue procedures, the Caltrans Confined Space Program (Chapter 14 of the Caltrans Safety Manual), and the Maintenance Confined Space Entry Procedures (Appendix B in the Maintenance Code of Safe Operating Practices). Additionally, no entry will be permitted unless the necessary air monitoring has been done, and a “Confined Space Entry Form” (PM-S-0040) has been completed. Supervisors must ensure workers are properly trained, and that the confined space operating procedures are being followed.

NOTE: Caltrans employees will not enter confined spaces with known or expected hazardous atmospheres—such as oxygen < 19.5% or > 23.5%, LEL > 1%, Hydrogen Sulfide > 10 ppm, Carbon Monoxide > 25 ppm. If employees experience symptoms of over-exposure---GET OUT---then attempt to determine cause. Contact the supervisor and the Safety Office for assistance.

All employees who will enter a confined space or are involved with confined space operations must be trained in Confined Space Safety every two (2) years.

8.44 **Trench And Excavation Safety**

Employees shall review Appendix D “Trench and Excavation Safety Guidelines” in the Maintenance Code of Safe Operating Practices before digging, drilling, or working in or near trenches or excavations. Supervisors shall ensure employees understand and follow these guidelines.

Caltrans workers shall not enter any trench or excavation until a supervisor or Superintendent has inspected the trench/excavation and the surrounding area to identify and/or correct any hazards. The supervisor or Superintendent must be competent and knowledgeable about soil classification, shoring/sloping techniques and requirements, access requirements, and the hazards of underground work. The inspection will be documented.

All trenches/excavations 5 feet or more in depth must be shored or sloped. Shallower trenches/excavations must be shored or sloped if needed. Also, a proper means of access (ladder, ramp, etc.) is required for all trenches/excavations.

If there is any doubt about the safety of an excavation, DO NOT ENTER. Obtain an engineering opinion and/or safety review before any work starts.

All work in trenches/excavations shall comply with the Construction Safety Orders, Article 6, Excavations (8CCR Sections 1540-1543).

8.45 Use of Reclaimed Water

Before employees use reclaimed water, they shall be told about the potential health hazards involved with contact or accidental ingestion of reclaimed water. They shall also be trained how to properly clean up after using it.

Reclaimed water must meet applicable coliform and health standards before it can be used by Caltrans personnel for irrigation or dust control. The county health department shall be contacted for guidance.

Contact with reclaimed water shall be kept to a minimum. Workers shall use impermeable (rubber) gloves and appropriate protective clothing. Supervisors should contact the local supplier to determine what other specific precautions should be taken.

Employees must have clean water and soap available at the work site when using reclaimed water. Workers shall be instructed to wash their hands thoroughly before eating, drinking, smoking, or going to the bathroom.

More information on the use of reclaimed water is found in the Maintenance Code of Safe Operating Practices.

8.46 Handling Chemicals and Hazardous Substances

Employees handling or exposed to hazardous materials will be trained in the hazards, proper handling, use, and disposal of the material before use. The Material Safety Data Sheet (MSDS) shall be reviewed and readily available. See Chapter 16, “Hazardous Materials Communication Program” of the Caltrans Safety Manual for specific requirements.

Employees responding to highway spills will follow Chapter “D5” of the Maintenance Manual, Volume 1, the First Responder Operations Reference Manual, and the Emergency Response Guidebook.

All disposal and storage of waste will comply with the Maintenance Hazardous Waste Manual.

Use of pesticides/herbicides will comply with Chapter “C2”, Vegetation Control, of the Maintenance Manual, Volume 1.

Contact the supervisor, safety office, Maintenance Hazardous Materials Coordinator, or Maintenance Landscape Specialist, for additional help or assistance.

8.47 Radioactive Incidents

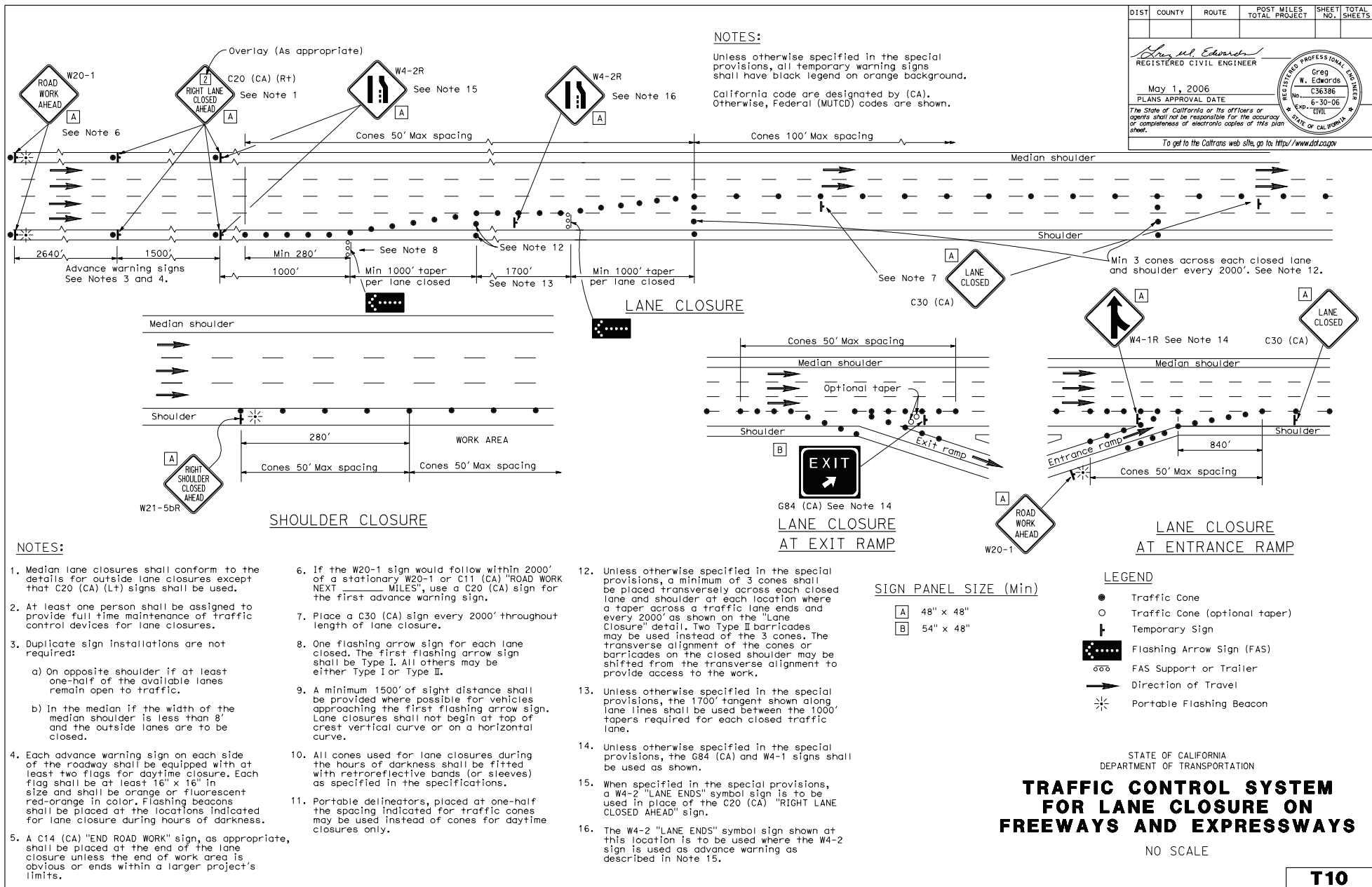
See Chapter “D5” – “Spills of Substances on Highway Rights of Way” and the First Responder Operations Reference Manual.

8.48 Explosives

Care in handling and storing explosives are specified in Chapter 5 – Blasting.

The Standard Plans T-10 through T17 contained in this Chapter 8 booklet have been printed utilizing the English measurement system. Any questions regarding these plans shall be directed to Headquarters/District Traffic Operations.

APPENDIX	T10 - Traffic Control System For Lane Closure on Freeways and Expressways
APPENDIX	T10A - Traffic Control System For Lane And Complete Closures on Freeways and Expressways
APPENDIX	T11 - Traffic Control System For Lane Closure on Multilane Conventional Highways
APPENDIX	T12 - Traffic Control System For Lane Closure on Multilane Conventional Highways
APPENDIX	T13 - Traffic Control System For Lane Closure on Two Lane Conventional Highways
APPENDIX	T14 - Traffic Control System For Ramp Closures
APPENDIX	T15 - Traffic Control System For Moving Lane Closure on Multilane Highways
APPENDIX	T16 - Traffic Control System For Moving Lane Closure on Multilane Highways
APPENDIX	T17 - Traffic Control System For Moving Lane Closure on Two Lane Highways



NOTES:

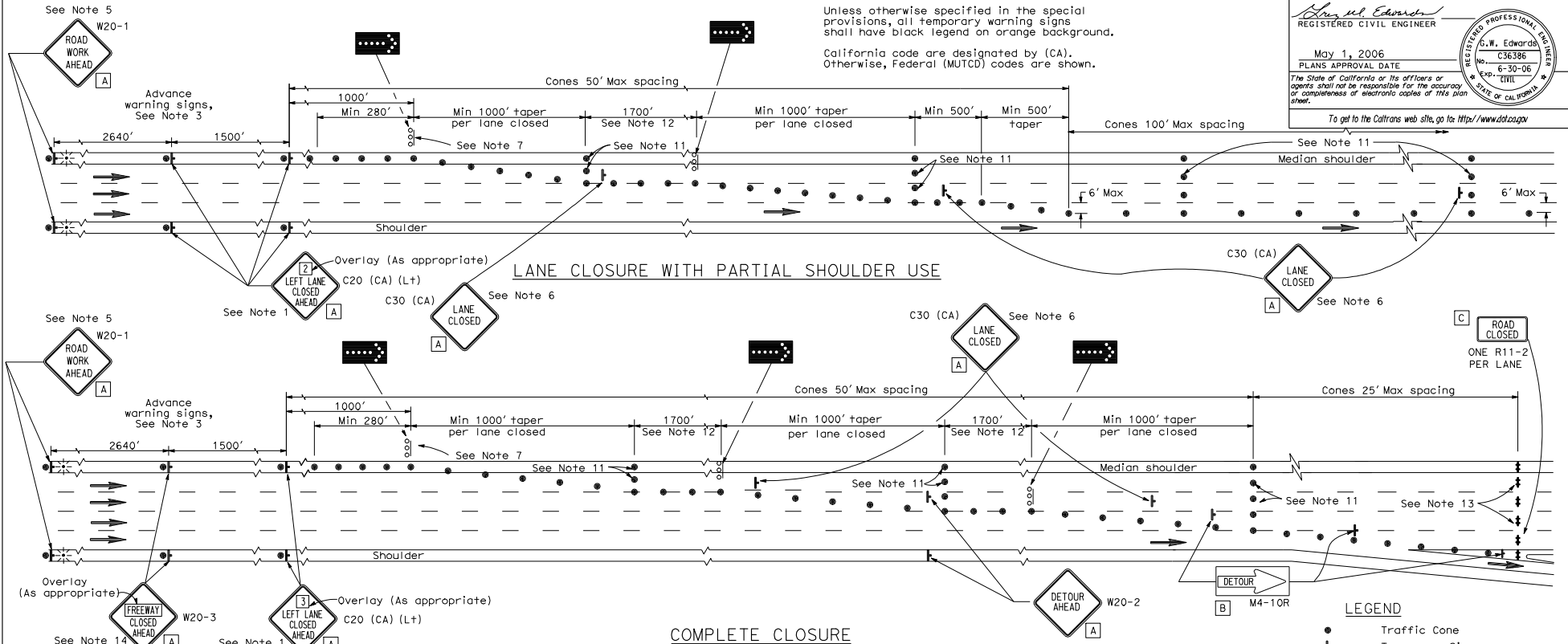
Unless otherwise specified in the special provisions, all temporary warning signs shall have black legend on orange background.

California code are designated by (CA). Otherwise, Federal (MUTCD) codes are shown.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET TOTAL SHEETS

Registered Civil Engineer
 May 1, 2006
 PLANS APPROVAL DATE
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G.W. Edwards
 C36386
 Exp. 6-30-06
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 STATE OF CALIFORNIA



NOTES:

1. Lane closures on the right side using partial median shoulder as a traffic lane shall conform to the details for inside lane closure except that C20 (CA) (Rt) signs shall be used.
2. At least one person shall be assigned to provide full time maintenance of traffic control devices for lane closures.
3. Each advance warning sign on each side of the roadway shall be equipped with at least two flags for daytime closure. Each flag shall be at least 16" X 16" in size and shall be orange or fluorescent red-orange in color. Flashing beacons shall be placed at the locations indicated for lane closure during hours of darkness.
4. A C14 (CA) "END ROAD WORK" sign, as appropriate, shall be placed at the end of the lane closure unless the end of work area is obvious or ends within a larger project's limits.
5. If the W20-1 sign would follow within 2000' of a stationary W20-1 or C11 (CA) "ROAD WORK NEXT ____ MILES", use a C20 (CA) sign for the first advance warning sign.
6. Place a C30 (CA) sign every 2000' throughout length of lane closure.

7. One flashing arrow sign for each lane closed. The first flashing arrow sign shall be Type I. All others may be either Type I or Type II.
8. A minimum 1500' of sight distance shall be provided where possible for vehicles approaching the first flashing arrow sign. Lane closures shall not begin at the top of crest vertical curve or on a horizontal curve.
9. All cones used for lane closures during the hours of darkness shall be fitted with retroreflective bands (or sleeves) as specified in the specifications.
10. Portable delineators, placed at one-half the spacing indicated for traffic cones, may be used instead of cones for daytime closures only.
11. Unless otherwise specified in the special provisions, a minimum of 3 cones shall be placed transversely across each closed lane and shoulder at each location where a taper across a traffic lane ends and every 2000' as shown on the "Lane Closure With Partial Shoulder Use" detail. Two Type II barricades may be used instead of the 3 cones. The transverse alignment of the cones or barricades on the closed shoulder may be shifted from the transverse alignment to provide access to the work.

12. Unless otherwise specified in the special provisions, the 1700' tangent shown along lane lines shall be used between the 1000' tapers required for each closed traffic lane.
13. A minimum of Two Type II barricades shall be placed across each closed lane and shoulder at the location shown and every 2000' within the complete closure area. Within the complete closure area, the transverse alignment of the barricades on the closed shoulder may be shifted from the transverse alignment to provide access to the work.
14. When specified in the special provisions, a W20-2 "DETOUR AHEAD" sign is to be used in place of the W20-3 "FREEWAY CLOSED AHEAD" sign.

SIGN PANEL SIZE (Min)

- A 48" x 48"
 B 48" x 18"
 C 48" x 30"

STATE OF CALIFORNIA
 DEPARTMENT OF TRANSPORTATION
**TRAFFIC CONTROL SYSTEM
 FOR LANE AND
 COMPLETE CLOSURES ON
 FREEWAYS AND EXPRESSWAYS**

NO SCALE

T10A

TYPICAL LANE CLOSURE

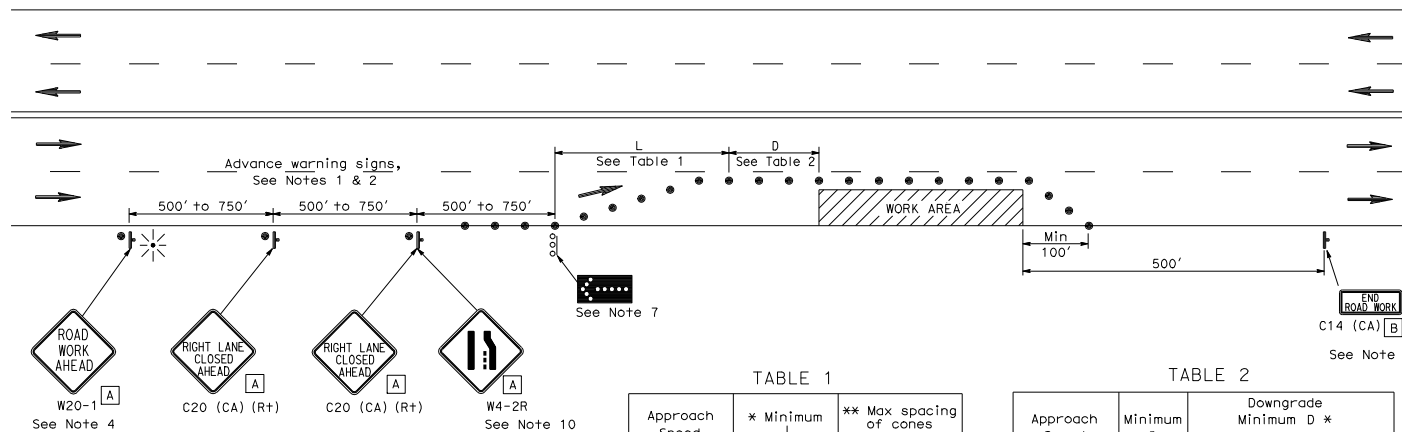


TABLE 1

Approach Speed	* Minimum L	** Max spacing of cones along taper
mph	ft	ft
20 and below	80	20
25	125	25
30	180	30
35	245	35
40	320	40
45	540	45
50	600	50
Over 50	See Note 9	
* Use L for lane widths less than or equal to 12'.		
** See Note 8.		

TABLE 2

Approach Speed	Minimum D	Downgrade Minimum D *		
		-3%	-6%	-9%
mph	ft	ft	ft	ft
25 and below	155	158	165	173
30	200	205	215	227
35	250	257	271	287
40	305	315	333	354
45	360	378	400	427
50	425	446	474	507
Over 50	See Note 9			
* Use on sustained downgrade steeper than - percent and longer than 1 mile.				

NOTES:

- Where approach speeds are low, advance warning signs may be placed at 300' spacing and placed closer in urban areas.
- Each advance warning sign shall be equipped with at least two flags for daytime closure. Each flag shall be at least 16" x 16" in size and shall be orange or fluorescent red-orange in color. Flashing beacons shall be placed at the locations indicated for lane closure during hours of darkness.
- A C14 (CA) "END ROAD WORK" sign, as appropriate, shall be placed at the end of the lane closure unless the end of work area is obvious, or ends within a larger project's limits.
- If the W20-1 or C11 (CA) "ROAD WORK NEXT MILES", use a C20 (CA) sign for the first advance warning sign.
- All cones used for lane closures during the hours of darkness shall be fitted with retroreflective bands (or sleeves) as specified in the specifications.
- Portable delineators, placed at one-half the spacing indicated for traffic cones, may be used instead of cones for daytime closures only.
- Flashing arrow sign shall be either Type I or Type II.
- The maximum spacing between cones along a tangent shall be 50' and along a taper shall be approximately as shown in Table 1.
- For approach speeds over 50 mph, use the "Traffic Control System for Lane Closure On Freeways And Expressways" plan for lane closure details and requirements.
- When specified in the special provisions, a W4-2 "LANE ENDS" symbol sign is to be used in place of the C20 (CA) "RIGHT LANE CLOSED AHEAD" sign.

NOTES:

Unless otherwise specified in the special provisions, all temporary warning signs shall have black legend on orange background.

California code are designated by (CA). Otherwise, Federal (MUTCD) codes are shown.

LEGEND

- Traffic Cone
- ⬇ Temporary Sign
- ➡ Direction of Travel
- ⬇ Flashing Arrow Sign (FAS)
- ⬇ FAS Support or Trailer
- ⬇ Portable Flashing Beacon

SIGN PANEL SIZE (Min)

- [A] 36" x 36"
- [B] 36" x 18"

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON MULTILANE CONVENTIONAL HIGHWAYS

NO SCALE

T11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

Greg W. Edwards
 REGISTERED CIVIL ENGINEER
 No. C36386
 Exp. 6-30-06
 CIVIL
 STATE OF CALIFORNIA

May 1, 2006
 PLANS APPROVAL DATE

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LEGEND

- Traffic Cone
- ⊥ Temporary Sign
- Direction of Travel
- Flashing Arrow Sign (FAS)
- FAS Support or Trailer
- ☼ Portable Flashing Beacon

TABLE 1

Approach Speed	* Minimum L	** Max spacing of cones along taper
mph	ft	ft
20 and below	80	20
25	125	25
30	180	30
35	245	35
40	320	40
45	540	45
50	600	50
Over 50	See Note 11	
* Use L for lane widths less than or equal to 12'.		
** See Note 10.		

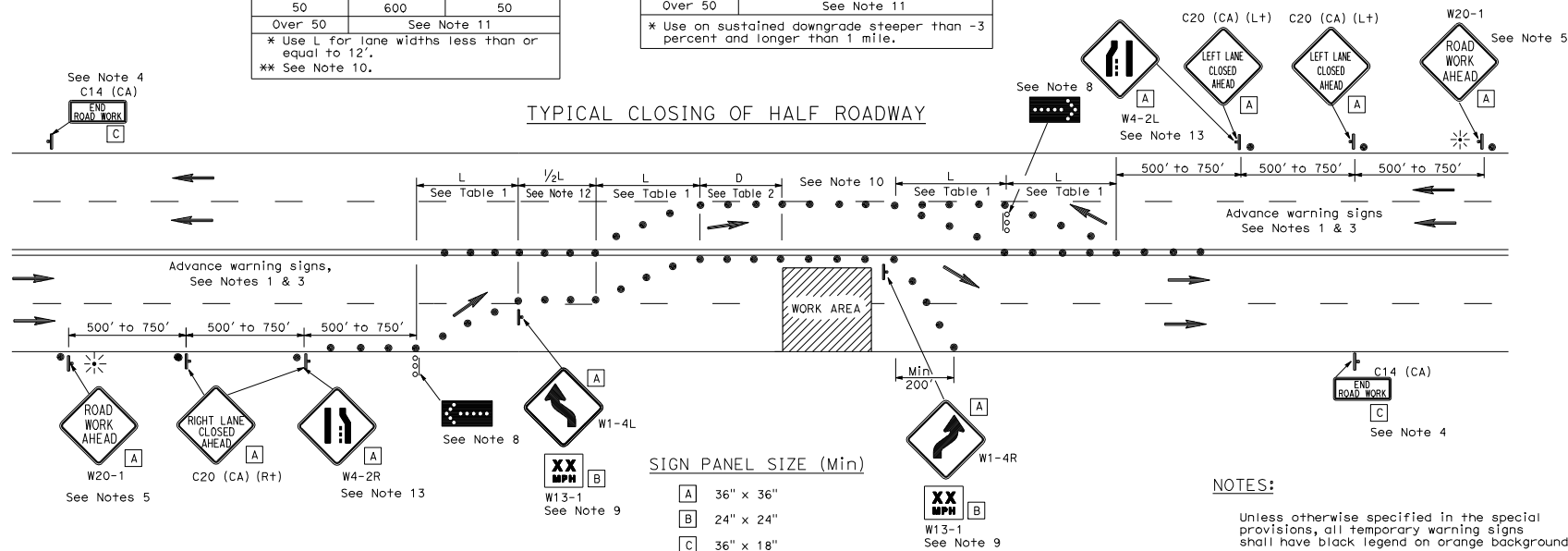
TABLE 2

Approach Speed	Minimum D	Downgrade Minimum D *		
		-3%	-6%	-9%
mph	ft	ft	ft	ft
25 and below	155	158	165	173
30	200	205	215	227
35	250	257	271	287
40	305	315	333	354
45	360	378	400	427
50	425	446	474	507
Over 50	See Note 11			
* Use on sustained downgrade steeper than -3 percent and longer than 1 mile.				

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

Registered Civil Engineer
 Greg W. Edwards
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STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON MULTILANE CONVENTIONAL HIGHWAYS

NO SCALE

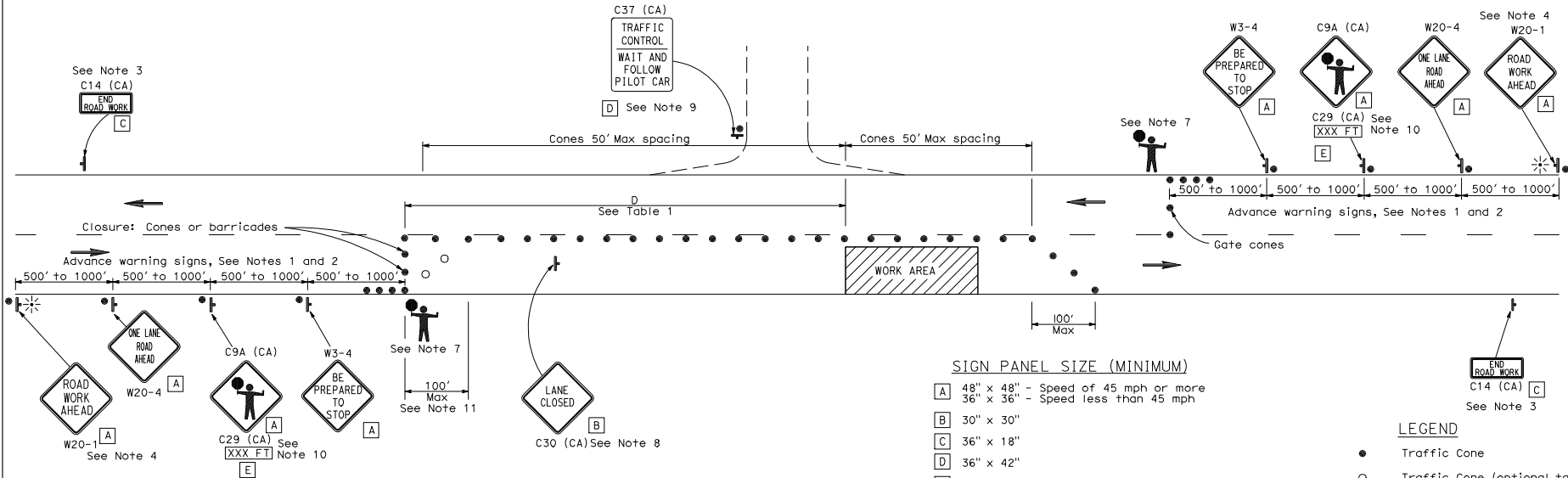
T12

NOTES:

Unless otherwise specified in the special provisions, all temporary warning signs shall have black legend on orange background.

California code are designated by (CA). Otherwise, Federal (MUTCD) codes are shown.

TYPICAL LANE CLOSURE WITH REVERSIBLE CONTROL



NOTES:

- Where approach speeds are low, advance warning signs may be placed at 300' spacing, and closer in urban areas.
- Each advance warning sign in each direction of travel shall be equipped with at least two flags for daytime closure. Each flag shall be at least 16" x 16" in size and shall be orange or fluorescent red-orange in color. Flashing beacons shall be placed at the locations indicated for lane closure during hours of darkness.
- A C14 (CA) "END ROAD WORK" sign, as appropriate, shall be placed at the end of the lane closure unless the end of work area is obvious, or ends within a larger project's limits.
- If the W20-1 sign would follow within 2000' of a stationary W20-1 or C11 (CA) "ROAD WORK NEXT _____ MILES", use a W20-4 sign for the first advance warning sign.
- All cones used for lane closures during the hours of darkness shall be fitted with retroreflective bands (or sleeves) as specified in the specifications.
- Portable delineators, placed at one-half the spacing indicated for traffic cones, may be used instead of cones for daytime closures only.

- Additional advance flaggers may be required. Flagger should stand in a conspicuous place, be visible to approaching traffic as well as approaching vehicles after the first vehicle has stopped. During the hours of darkness, the flagging station and flagger shall be illuminated and clearly visible to approaching traffic. The illumination footprint of the lighting on the ground shall be at least 20' in diameter. Place a minimum of four cones at 50' intervals in advance of flagger.
- Place C30 (CA) "LANE CLOSED" sign at 500' to 1000' intervals throughout extended work areas. They are optional if the work area is visible from the flagger station.
- When a pilot car is used, place a C37 (CA) "TRAFFIC CONTROL-WAIT AND FOLLOW PILOT CAR" sign at all intersections within traffic control area. Signs shall be clean and visible at all times.
- An optional C29 (CA) sign may be placed below the C9A (CA) sign.
- Traffic cones or barricades may be placed on the optional taper as shown, barricades shall be Type I, II, or III.

SIGN PANEL SIZE (MINIMUM)				
A	48" x 48"	Speed of 45 mph or more		
	36" x 36"	Speed less than 45 mph		
B	30" x 30"			
C	36" x 18"			
D	36" x 42"			
E	36" x 9"			

TABLE 1				
Approach Speed	Minimum D	Downgrade Minimum D *		
		-3%	-6%	-9%
mph	ft	ft	ft	ft
25 and below	155	158	165	173
30	200	205	215	227
35	250	257	271	287
40	305	315	333	354
45	360	378	400	427
50	425	446	474	507
55	495	520	553	593
60	570	598	638	686
65	645	682	728	785

* Use on sustained downgrade steeper than -3 percent and longer than 1 mile.

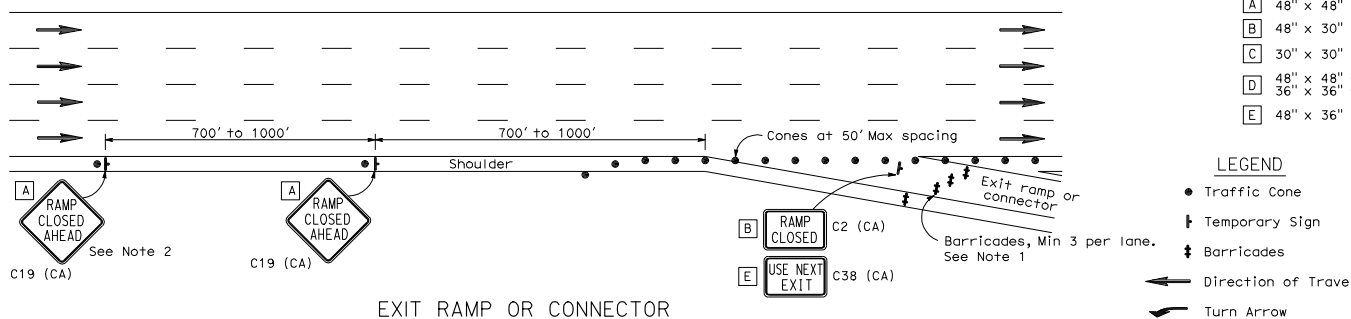
TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON TWO LANE CONVENTIONAL HIGHWAYS

NO SCALE

T13

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET TOTAL SHEETS
Greg W. Edwards REGISTERED CIVIL ENGINEER				
May 1, 2006 PLANS APPROVAL DATE				
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TYPICAL RAMP CLOSURES



SIGN PANEL SIZE (Min)

- | | |
|---|-----------|
| A | 48" x 48" |
| B | 48" x 30" |
| C | 30" x 30" |
| D | 48" x 48" |
| E | 36" x 36" |
- Speed of 50 mph or more
- Speed less than 50 mph

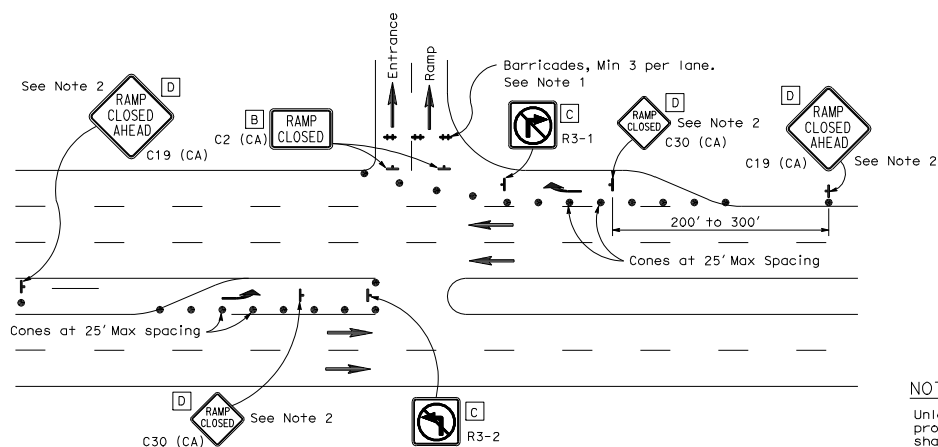
LEGEND

- Traffic Cone
- † Temporary Sign
- ‡ Barricades
- ← Direction of Travel
- ↩ Turn Arrow

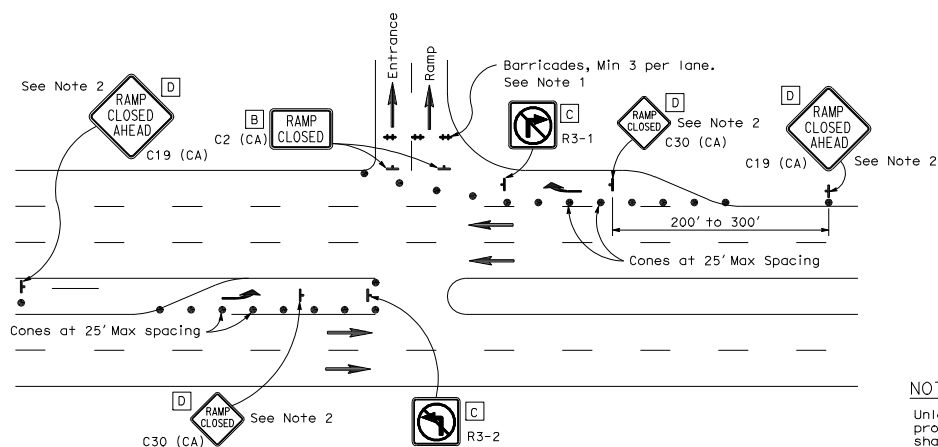
NOTES:

- Barricades shall be Type I, II, or III for closures lasting one week or less and Type III for closures lasting longer than one week.
- In addition to placing the C19 (CA) "RAMP CLOSED AHEAD" and C30 (CA) "RAMP CLOSED" signs, black on orange overlay plates with the word "CLOSED" may be mounted, as directed by the Engineer, on all guide signs that refer to the closed ramp. The letter size on the overlay shall be the same as the guide sign.
- Each advance C19 (CA) "RAMP CLOSED AHEAD" sign shall be equipped with at least two flags for daytime closure. Each flag shall be at least 16" x 16" in size and shall be orange or fluorescent red-orange in color.
- All cones used for ramp closures during the hours of darkness shall be fitted with retroreflective bands (or sleeves) as specified in the specifications.
- Portable delineators, placed at one-half the spacing indicated for traffic cones, may be used instead of cones for daytime ramp closures only.
- At least one person shall be assigned to provide full time maintenance of traffic control devices, unless otherwise directed by the Engineer.
- The existing "EXIT" sign in the gore area shall be covered during ramp closures.

EXIT RAMP OR CONNECTOR WITH ADDITIONAL LANE



ENTRANCE RAMP WITH TURNING POCKETS

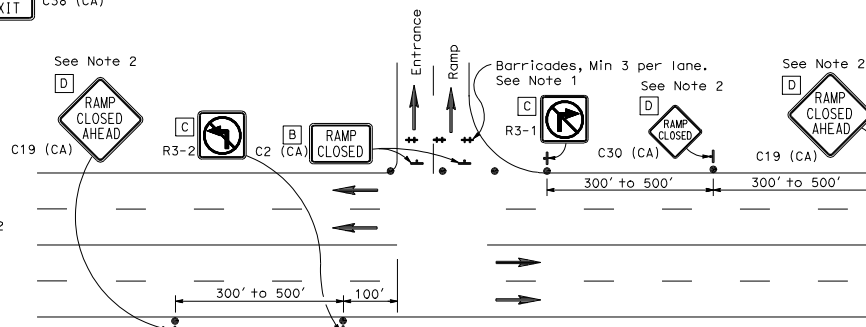


NOTES:

Unless otherwise specified in the special provisions, all temporary warning signs shall have black legend on orange background.

California code are designated by (CA).
Otherwise, Federal (MUTCD) codes are shown.

ENTRANCE RAMP WITHOUT TURNING POCKETS



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL SYSTEM FOR RAMP CLOSURE

NO SCALE

T14

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

Greg W. Edwards
 REGISTERED CIVIL ENGINEER
 No. C36386
 Exp. 6-30-06
 CIVIL
 STATE OF CALIFORNIA

May 1, 2006
 PLANS APPROVAL DATE
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 To get to the Caltrans web site go to <http://www.dot.ca.gov>

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

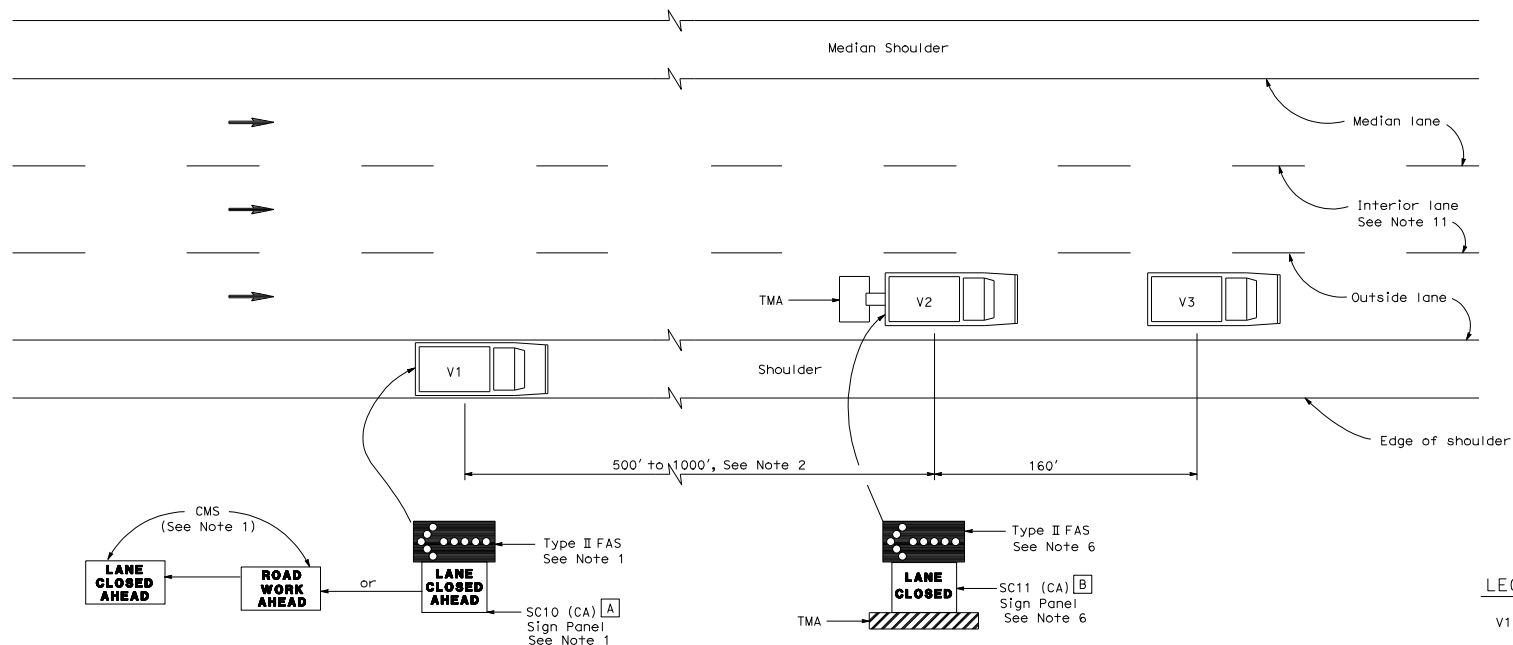
Greg W. Edwards
 REGISTERED CIVIL ENGINEER

May 1, 2006
 PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER
 Greg W. Edwards
 No. C36386
 Exp. 6-30-06
 CIVIL
 STATE OF CALIFORNIA



SIGN PANEL SIZE (Min)

- A 66" x 36"
- B 54" x 42"

LEGEND

- V1 Sign Vehicle
- V2 Shadow Vehicle
- V3 Work/Application Vehicle
- Flashing Arrow Sign (FAS)
- CMS Changeable Message Sign
- TMA Truck-Mounted Attenuator
- Direction of Travel

MOVING LANE CLOSURE ON MEDIAN LANE OR
OUTSIDE LANE OF MULTILANE HIGHWAYS

NOTES:

- Either a changeable message sign or a SC10 (CA) sign panel and a Type II flashing arrow sign shall be mounted on the rear of sign vehicle V1. A Type II flashing arrow sign shall be mounted on the rear of sign vehicle V1 and used with the SC10 (CA) sign panel. A Type II flashing arrow sign will not be required with the changeable message sign provided the flashing arrow sign symbol is displayed on the changeable message sign board. The changeable message sign shall be sequenced to show the "ROAD WORK AHEAD" message first, followed by the "LANE CLOSED AHEAD" message and then the flashing arrow sign symbol. For median lane closure, the flashing arrow sign symbol shall be reversed with the arrowhead on the right.
- If traffic queues develop, sign vehicle V1 should be positioned upstream from the end of queue. Sign vehicle V1 shall be positioned where highly visible when shoulders are not available.
- A minimum sight distance of 1500' should be provided in advance of sign vehicle V1.
- Sign vehicle V1 should remain at the beginning of horizontal or vertical curves until the other vehicles (V2 and V3) are far enough beyond the curve to resume the minimum sight distance of 1500'.
- Vehicle-mounted sign panels shall be Type III, IV, VII, VIII or IX retroreflective sheeting, black on white, black on orange, or black on fluorescent orange, with 6" minimum series D letters per Caltrans sign specifications.
- Gross Vehicle Weight of shadow vehicle V2 shall be a minimum of 20,000 pounds and shall be equipped with a truck-mounted attenuator. The sign panel shown and a Type II flashing arrow sign shall be mounted on the rear of shadow vehicle V2. For median lane closure the flashing arrow sign symbol shall be displayed with the arrowhead on the right.
- All vehicles used for lane closures shall be equipped with two-way radios, and the vehicle operators shall maintain communication during the work or application operation.
- All vehicles shall be equipped with flashing or rotating amber lights.
- Where sufficient shoulder width is not available, sign vehicle V1 may encroach into the traffic lane staying as close to the edge of shoulder as practicable. Both V1 and V2 shall be equipped with a truck-mounted attenuator. The Gross Vehicle Weight of V1 and V2 shall be at least 20,000 pounds, respectively.
- Where workers would be on foot in the work area, a stationary type lane closure (Standard Plan T10, T11, etc., as applicable) shall be used instead of this plan.
- For moving lane closure on interior lane of multilane highways, use Standard Plan T16.
- When multiple work vehicles are used in close proximity to each other, only one shadow vehicle is required, and spacing between work vehicles shall be minimized in order to deter traffic from entering the closed lane.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

**TRAFFIC CONTROL SYSTEM
FOR MOVING LANE CLOSURE
ON MULTILANE HIGHWAYS**

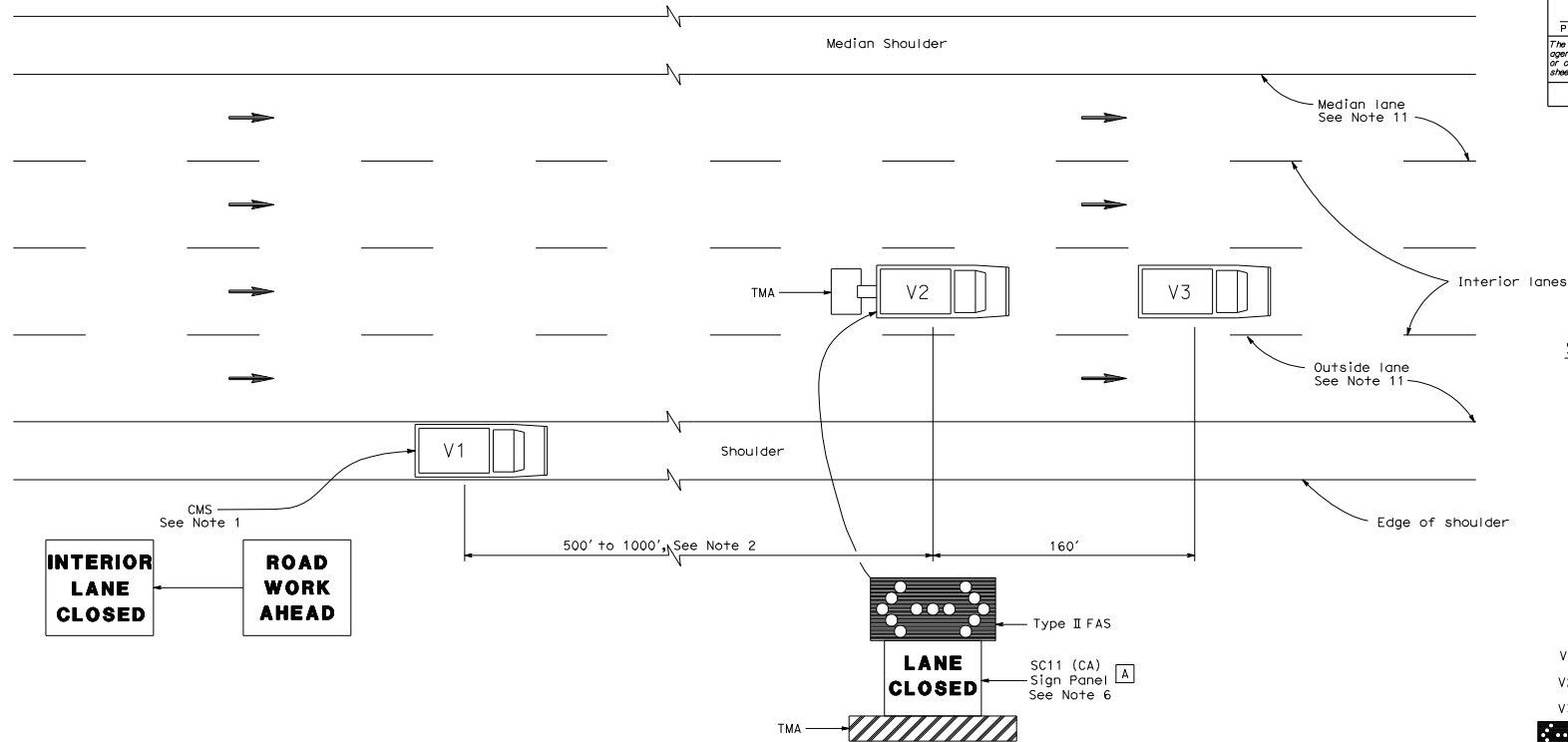
NO SCALE

T15

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

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REGISTERED CIVIL ENGINEER
 Greg W. Edwards
 No. C36386
 Exp. 6-30-06
 CIVIL
 STATE OF CALIFORNIA



SIGN PANEL SIZE (Min)

A 54" x 42"

LEGEND

- V1 Sign Vehicle
 V2 Shadow Vehicle
 V3 Work/Application Vehicle
 Flashing Arrow Sign (FAS) In flashing double arrow mode
 CMS Changeable Message Sign
 TMA Truck-Mounted Attenuator
 Direction of Travel

MOVING LANE CLOSURE ON INTERIOR LANE OF MULTILANE HIGHWAYS

NOTES:

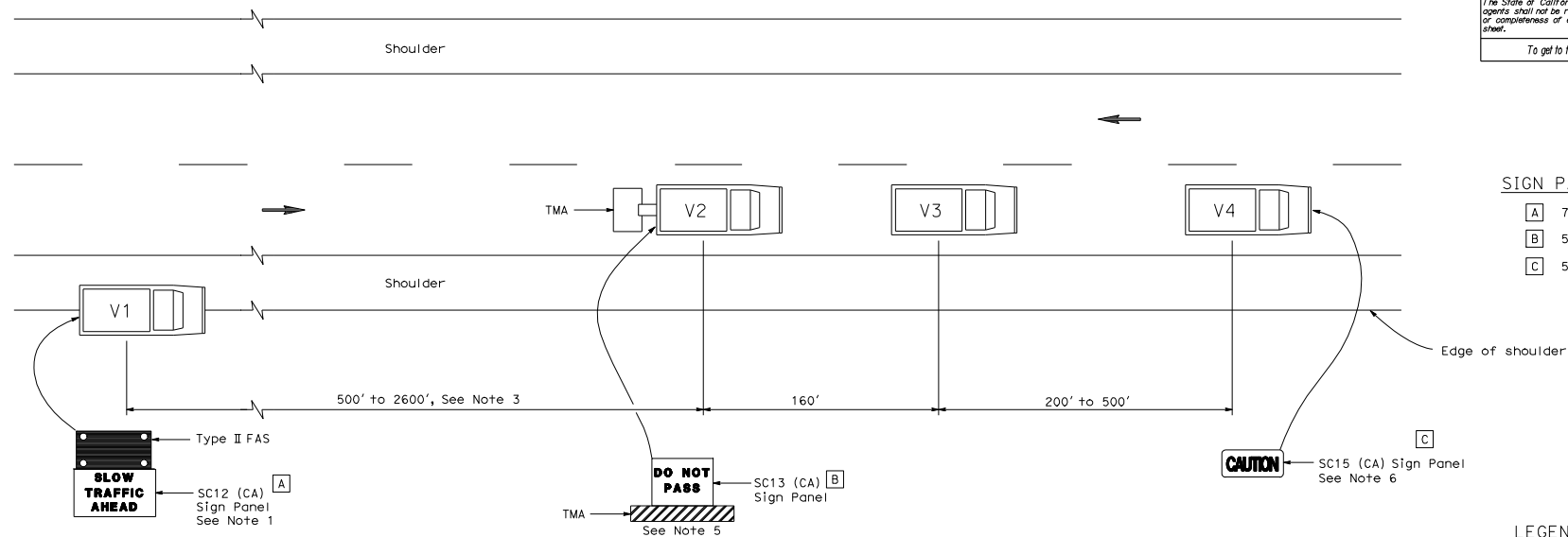
- A changeable message sign shall be mounted on the rear of sign vehicle V1. The changeable message sign shall be sequenced to show the "ROAD WORK AHEAD" message first, followed by the "INTERIOR LANE CLOSED" message. The message "CENTER LANE CLOSED" may be used in place of the "INTERIOR LANE CLOSED" message.
- If traffic queues develop, sign vehicle V1 should be positioned upstream from the end of queue. Sign vehicle V1 shall be positioned where highly visible when shoulders are not available.
- A minimum sight distance of 1500' should be provided in advance of sign vehicle V1.
- Sign vehicle V1 should remain at the beginning of horizontal or vertical curves until the other vehicles (V2 and V3) are far enough beyond the curve to resume the minimum sight distance of 1500'.
- Vehicle-mounted sign panels shall be Type III, IV, VII, VIII, or IX retroreflective sheeting, black on white, black on orange, or black on fluorescent orange, with 6" minimum series D letters per Caltrans sign specifications.
- Gross Vehicle Weight of shadow vehicle V2 shall be a minimum of 20,000 pounds and shall be equipped with a truck-mounted attenuator. The sign panel shown and a Type II flashing arrow sign shall be mounted on the rear of shadow vehicle V2.
- All vehicles used for lane closures shall be equipped with two-way radios, and the vehicle operators shall maintain communication during the work or application operation.
- All vehicles shall be equipped with flashing or rotating amber lights.
- Where sufficient shoulder width is not available, sign vehicle V1 may encroach into the traffic lane staying as close to the edge of shoulder as practicable. Both V1 and V2 shall be equipped with a truck-mounted attenuator. The Gross Vehicle Weight of V1 and V2 shall be at least 20,000 pounds, respectively.
- Where workers would be on foot in the work area, a stationary type lane closure (Standard Plan T10, T11 etc., as applicable) shall be used instead of this plan.
- For moving lane closure on median lane or outside lane of multilane highways, use Standard Plan T15.
- When multiple work vehicles are used in close proximity to each other, only one shadow vehicle is required, and spacing between work vehicles shall be minimized in order to deter traffic from entering the closed lane.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL SYSTEM FOR MOVING LANE CLOSURE ON MULTILANE HIGHWAYS

NO SCALE

T16



NOTES:

1. Either a changeable message sign or a SC12 (CA) "SLOW TRAFFIC AHEAD" sign shall be mounted on the rear of sign vehicle V1. A Type II flashing arrow sign may be used with the SC12 (CA) sign panel.
2. Sign vehicle V1 should be positioned where highly visible when shoulders are not available.
3. If traffic queues develop, sign vehicle V1 should be positioned upstream from the end of queue.
4. Vehicle-mounted sign panels shall be Type III, IV, VII, VIII or IX retroreflective sheeting, black on white, black on orange, or black on fluorescent orange, with 6" minimum series D letters per Caltrans sign specifications.
5. Gross Vehicle Weight of shadow vehicle shall be a minimum of 20,000 pounds and shall be equipped with a truck-mounted attenuator. The sign panel shown shall be mounted on the rear of shadow vehicle V2. The message "LANE CLOSED" may be used in place of the "DO NOT PASS" message.
6. The sign panel shown shall be mounted on the front of sign vehicle V4, facing opposing traffic.
7. All vehicles shall be equipped with flashing or rotating amber lights.
8. Sign vehicle V4 will not be required when the work and vehicles V2 and V3 are 2' or more from the centerline of the highway during the work or application operations.
9. All vehicles used for lane closures shall be equipped with two-way radios and the vehicle operators shall maintain communication during the work or application operation.
10. This plan shall not be used where workers would be on foot in the work area. Use a stationary type lane closure (Standard Plan T13) for this condition.
11. When multiple work vehicles are used in close proximity to each other, only one shadow vehicle is required and spacing between work vehicles shall be minimized in order to deter traffic from entering the closed lane.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

Greg W. Edwards
 REGISTERED CIVIL ENGINEER
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Greg W. Edwards
 No. C36386
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 CIVIL
 STATE OF CALIFORNIA

SIGN PANEL SIZE (Min)

- | | |
|---|-----------|
| A | 72" x 42" |
| B | 54" x 42" |
| C | 54" x 24" |

LEGEND

- | | |
|-----|--|
| V1 | Sign Vehicle |
| V2 | Shadow Vehicle |
| V3 | Work/Application Vehicle |
| V4 | Sign Vehicle |
| TMA | Truck-Mounted Attenuator |
| → | Direction of Travel |
| ⬢ | Flashing Arrow Sign (FAS) in flashing caution mode |

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

**TRAFFIC CONTROL SYSTEM
FOR MOVING LANE CLOSURE
ON TWO LANE HIGHWAYS**

NO SCALE

T17